

06/21/00



JCS52 U.S. PTO

06-23-00

A

Please type a plus sign (+) inside this box → ☐
 Approved for use through 09/30/2000. OMB 0651-0032  
 Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE  
 Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

<b>UTILITY PATENT APPLICATION TRANSMITTAL</b> (Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))	Attorney Docket No.	2230
	First Inventor or Application Identifier	YOUNG et al.
	Title	Method and System for Remote Client Installation
	Express Mail Label No.	EJ743271764US

<b>APPLICATION ELEMENTS</b> See MPEP chapter 600 concerning utility patent application contents.	<b>ADDRESS TO:</b> Assistant Commissioner for Patents Box Patent Application Washington, DC 20231
---	--

- ☐ \* Fee Transmittal Form (e.g., PTO/SB/17)  
(Submit an original and a duplicate for fee processing)
- ☒ Specification [Total Pages 49]  
(preferred arrangement set forth below)
  - Descriptive title of the invention
  - Cross References to Related Applications
  - Statement Regarding Fed sponsored R & D
  - Reference to Microfiche Appendix
  - Background of the Invention
  - Brief Summary of the Invention
  - Brief Description of the Drawings (if filed)
  - Detailed Description
  - Claim(s)
  - Abstract of the Disclosure
- ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 25]
- Oath or Declaration [Total Pages 2]
  - ☒ Newly executed (original or copy)
  - ☐ Copy from a prior application (37 C.F.R. § 1.63(d))  
(for continuation/divisional with Box 16 completed)
    - ☐ DELETION OF INVENTOR(S)  
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).
- ☐ Microfiche Computer Program (Appendix)
- Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
  - ☐ Computer Readable Copy
  - ☐ Paper Copy (identical to computer copy)
  - ☐ Statement verifying identity of above copies

<b>ACCOMPANYING APPLICATION PARTS</b>	
7. <input checked="" type="checkbox"/> Assignment Papers (cover sheet & document(s))	
8. <input type="checkbox"/> 37 C.F.R. § 3.73(b) Statement (when there is an assignee)	<input type="checkbox"/> Power of Attorney
9. <input type="checkbox"/> English Translation Document (if applicable)	
10. <input type="checkbox"/> Information Disclosure Statement (IDS)/PTO-1449	<input type="checkbox"/> Copies of IDS Citations
11. <input type="checkbox"/> Preliminary Amendment	
12. <input checked="" type="checkbox"/> Return Receipt Postcard (MPEP 503) (Should be specifically itemized)	
13. <input type="checkbox"/> * Small Entity Statement(s) filed in prior application, (PTO/SB/09-12)	<input type="checkbox"/> Status still proper and desired
14. <input type="checkbox"/> Certified Copy of Priority Document(s) (if foreign priority is claimed)	
15. <input type="checkbox"/> Other:	

**\* NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).**

16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:  
☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: \_\_\_\_\_  
 Prior application information: Examiner \_\_\_\_\_ Group / Art Unit: \_\_\_\_\_

For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

<b>17. CORRESPONDENCE ADDRESS</b>					
<input type="checkbox"/> Customer Number or Bar Code Label			or <input checked="" type="checkbox"/> Correspondence address below		
(Insert Customer No. or Attach bar code label here)					
Name	Albert S. Michalik, Reg. No. 37,395				
Address	Michalik & Wylie, PLLC				
	14645 Bel-Red Road				
	Suite 103				
City	Bellevue	State	Washington	Zip Code	98007
Country	USA	Telephone	(425) 653-3520	Fax	(425) 653-3603

Name (Print/Type)	Albert S. Michalik	Registration No. (Attorney/Agent)	37,395
Signature	<i>Albert S. Michalik</i>	Date	6/21/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

 06/21/00  
 09/599156  
 06/21/00

In re Application of YOUNG et al.  
Attorney Docket No. 2230

CERTIFICATE OF MAILING BY "EXPRESS MAIL"

"Express Mail" mailing label number EJ743271764US

Date of Deposit: June 21, 2000

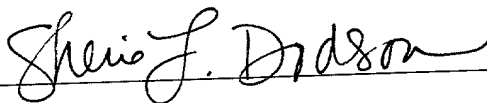
I hereby certify that the following documents:

New Patent Application in the name of Jeff Young and Bruce W. Copeland for "**Method and System for Remote Client Installation,**" including 1 Page Cover Sheet, 35 Pages Specification, 12 Pages Claims, 1 Page Abstract, 25 Sheets Of Drawings, Transmittal Sheet, Fee Transmittal Sheet, Executed Declaration, Recordation Form Cover Sheet, Assignment

are being deposited with the United States Postal Service "Express Mail Post Office To Addressee" Service under 37 C.F.R. 1.10 on the date indicated above and is addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.

Sherie L. Dodson

(Typed or printed name of person mailing paper or fee)



(Signature of person mailing paper or fee)

S P E C I F I C A T I O N

TO ALL WHOM IT MAY CONCERN:

Be it known that we, Jeff Young, a citizen of the United States, residing at 2113 Bellevue Way SE, Bellevue, Washington 98004, and Bruce W. Copeland, a citizen of the United States, residing at 25618 NE 100th Street, Redmond, Washington 98053, have invented a certain new and useful **METHOD AND SYSTEM FOR REMOTE CLIENT INSTALLATION** of which the following is a specification.

007230-95T66360

# METHOD AND SYSTEM FOR REMOTE CLIENT INSTALLATION

## FIELD OF THE INVENTION

5 The invention relates generally to computer systems, and particularly to installing client computer systems in a computer network.

## BACKGROUND OF THE INVENTION

10 Many enterprises having computer networks want their client computers to be carefully managed by an administrator or the like from a central location. Such centralized management includes deploying applications to the client computers, maintaining and upgrading applications, and removing other applications.

15 However, before a client computer can be centrally managed, it is necessary to install management software on the client machine. This process is generally referred to as "Client Installation." When dealing with relatively small networks, it is possible for administrators to personally  
20 visit each client computer and install the management software thereon. However, as networks grow, e.g., on the order of many thousands of machines, visiting each machine becomes impractical, if not impossible. Teams of installers have been

employed for this purpose, however this has its own drawbacks, including significant expense.

Attempts to automate client installation have heretofore still required considerable manual intervention at the client machine. In the most common form of this manual intervention, each end user is required to log onto the computer system, which causes pre-configured logon scripts to run. The scripts then handle the installation of the management software. As another common alternative, the user may manually connect to a server from the client machine, and execute a batch file or executable program to initiate the installation of client software.

A first problem with this "logon script" method of installing the management software on client computers is that administrators do not have an automated and scalable way to initiate the installation. For example, if an administrator knows of the existence of a group of computers, and wants to install management software agents on those computers, the administrator has to wait for actions to occur on the local machine, i.e., a user logon or user connection to a server and execution of a batch file. The running of logon scripts is rather unpredictable, as some systems, especially servers, rarely have users logging onto them, some systems are not

configured to run logon scripts, and some systems have users  
logged on for extended periods of time before logging off and  
logging back on again. The manual running of a batch file is  
also not very desirable, as many users are unable or unwilling  
5 to perform this task.

Another drawback to logon script installation is that  
after the user begins the process of logging onto the machine,  
the use of logon scripts for the time-consuming task of  
installing and/or configuring software causes potentially  
10 unacceptable delays before a user is able to begin using the  
computer. Moreover, logon scripts cannot always be hidden  
from the user during execution, which allows the user to  
interfere with the execution of the logon script, and/or call  
for support merely to ask why the script is running.  
15 Interfering with the logon script defeats the very purpose of  
client management, while calls to a support desk to inquire  
about scripts are expensive and needless.

Moreover, the server is still highly involved in manual  
installations, which causes other problems, including security  
20 and scalability issues. More particularly, for complete  
installation of management software onto client machines, the  
servers are configured with a security account having  
"Administrator" rights to all client machines. This presents

a security concern, because access to such an account allows remote access to virtually all aspects of all client machines. Also, to configure the client machines, the ratio of servers to client machines can be one-to-a thousand or more, and the work performed by the server can only be done to a very small number of clients at a time. A bottleneck often results from this scalability problem.

#### SUMMARY OF THE INVENTION

10 Briefly, the present invention provides a method and system to install management software on client machines without requiring client-side action (e.g., user-intervention). A data discovery manager running on a server determines via a set of rules which discovered machines in a network should be configured for client installation, and  
15 queues a client configuration request (CCR) for each such machine. A client configuration manager running on a server dequeues each CCR, and attempts to establish a connection with the remote machine corresponding to the CCR. If unsuccessful,  
20 (e.g., because of no connection or improper security rights), the CCR is placed in a retry queue for later attempts to establish the connection. A status message is output if retries are unsuccessful for too long.

1007290" 95766560

If a successful connection is established, a small number of files are put on the machine, one of which is a bootstrap install service registered in the client machine's registry as a service. A service manager runs the install program, essentially starting a bootstrap process that operates to access the registry and connect the client machine to a client access point (CAP) server that is identified to the client and stored in its registry. The bootstrap service then installs the remainder of the management software on the client machine from the CAP.

Because such installations can fail, the CCR for a started installation is marked as started and added to the retry queue. When the Client Configuration Manager service later dequeues that CCR, it checks to see if installation was successful. If so, the CCR is removed from the queue, but if not, the CCR is used to reattempt the installation.

In one enhanced implementation described herein, to avoid some of the security and scalability problems, when the logged on user has sufficient security permissions, a CCR is not generated by the client machine. Instead, if a logged-on user has sufficient rights, a client logon process performs the install. As a result, for such users, the server need not initiate a connection to the client, nor does a security



account with administrator privileges need to be set up on the server. The security and scalability (e.g., bottleneck) problems related to server-initiated installations are thus avoided for users having sufficient security permissions.

5 Other advantages will become apparent from the following detailed description when taken in conjunction with the drawings, in which:

#### BRIEF DESCRIPTION OF THE DRAWINGS

10 FIGURE 1 is a block diagram representing a computer system into which the present invention may be incorporated;

FIG. 2 is a block diagram generally representing discovery of network resources;

15 FIGS. 3 and 4 are block diagrams generally representing components and network resources for the preparation of a network for network discovery;

FIG. 5 is a block diagram generally representing one type of network discovery, logon discovery, from a client machine perspective;

20 FIGS. 6 - 8 block diagrams generally representing components underlying a client installation infrastructure;

FIG. 9 is a block diagram generally representing one type of client installation, logon installation;

FIG. 10 is a block diagram generally representing client installation on a machine having administrator rights;

FIG. 11 is a block diagram generally representing client installation on a machine that does not have administrator  
5 rights;

FIG. 12 is a block diagram generally representing remote client installation in accordance with an aspect of the present invention;

FIG. 13 is a block diagram generally representing various  
10 client components installed via remote client installation in accordance with an aspect of the present invention;

FIGS. 14 and 15 comprise a flow diagram generally representing a general process for creating client configuration requests for machines discovered by network  
15 discovery, in accordance with an aspect of the present invention;

FIG. 16 is a flow diagram generally representing the handling of client configuration requests to accomplish remote client installation in accordance with an aspect of the  
20 present invention;

FIGS. 17 - 21 comprise a flow diagram generally representing logon installation; and

FIGS. 22 - 25 comprise a flow diagram generally

representing client installation, including general steps performed in remote client installation in accordance with an aspect of the present invention.

5

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

### EXEMPLARY OPERATING ENVIRONMENT

FIGURE 1 and the following discussion are intended to provide a brief general description of a suitable computing environment in which the invention may be implemented.

10 Although not required, the invention will be described in the general context of computer-executable instructions, such as program modules, being executed by a personal computer. Generally, program modules include routines, programs, objects, components, data structures and the like that perform  
15 particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the invention may be practiced with other computer system configurations, including hand-held devices, multi-processor systems, microprocessor-based or programmable consumer  
20 electronics, network PCs, minicomputers, mainframe computers and the like. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a

communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

With reference to FIG. 1, an exemplary system for  
5 implementing the invention includes a general purpose  
computing device in the form of a conventional personal  
computer 20 or the like acting as a node (i.e., system) in a  
clustering environment. The computer 20 includes a processing  
unit 21, a system memory 22, and a system bus 23 that couples  
10 various system components including the system memory to the  
processing unit 21. The system bus 23 may be any of several  
types of bus structures including a memory bus or memory  
controller, a peripheral bus, and a local bus using any of a  
variety of bus architectures. The system memory includes  
15 read-only memory (ROM) 24 and random access memory (RAM) 25.  
A basic input/output system 26 (BIOS), containing the basic  
routines that help to transfer information between elements  
within the personal computer 20, such as during start-up, is  
stored in ROM 24. The personal computer 20 may further  
20 include a hard disk drive 27 for reading from and writing to a  
hard disk, not shown, a magnetic disk drive 28 for reading  
from or writing to a removable magnetic disk 29, and an  
optical disk drive 30 for reading from or writing to a

removable optical disk 31 such as a CD-ROM or other optical media. The hard disk drive 27, magnetic disk drive 28, and optical disk drive 30 are connected to the system bus 23 by a hard disk drive interface 32, a magnetic disk drive interface 33, and an optical drive interface 34, respectively. The drives and their associated computer-readable media provide non-volatile storage of computer readable instructions, data structures, program modules and other data for the personal computer 20. Although the exemplary environment described herein employs a hard disk, a removable magnetic disk 29 and a removable optical disk 31, it should be appreciated by those skilled in the art that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, Bernoulli cartridges, random access memories (RAMs), read-only memories (ROMs) and the like may also be used in the exemplary operating environment.

A number of program modules may be stored on the hard disk, magnetic disk 29, optical disk 31, ROM 24 or RAM 25, including an operating system 35 (preferably Windows® 2000), one or more application programs 36, other program modules 37 and program data 38. A user may enter commands and information into the personal computer 20 through input

007290-9576550

devices such as a keyboard 40 and pointing device 42. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner or the like. These and other input devices are often connected to the processing unit 21 through a serial port interface 46 that is coupled to the system bus, but may be connected by other interfaces, such as a parallel port, game port or universal serial bus (USB). A monitor 47 or other type of display device is also connected to the system bus 23 via an interface, such as a video adapter 48. In addition to the monitor 47, personal computers typically include other peripheral output devices (not shown), such as speakers and printers.

The personal computer 20 may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer 49. The remote computer 49 may be another personal computer, a server, a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements described above relative to the personal computer 20, although only a memory storage device 50 has been illustrated in FIG. 1. The logical connections depicted in FIG. 1 include a local area network (LAN) 51 and a wide area network (WAN) 52. Such networking environments are commonplace in offices, enterprise-wide

computer networks, Intranets and the Internet.

When used in a LAN networking environment, the personal computer 20 is connected to the local network 51 through a network interface or adapter 53. When used in a WAN  
5 networking environment, the personal computer 20 typically includes a modem 54 or other means for establishing communications over the wide area network 52, such as the Internet. The modem 54, which may be internal or external, is connected to the system bus 23 via the serial port interface  
10 46. In a networked environment, program modules depicted relative to the personal computer 20, or portions thereof, may be stored in the remote memory storage device. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between  
15 the computers may be used. For purposes of the following description, the computer system 20 may comprise the client system to which management software is installed, while the remote computers 49 may comprise network servers, such as site servers, domain controllers (logon points), and client access  
20 points, described below. Note that a site, which typically (but not necessarily) corresponds to a physical location or some logical grouping of computers, comprises one or more ranges of IP addresses of which computers can be members.

## CLIENT DISCOVERY AND INSTALLATION

FIGS. 2 - 14 provide a general representation of the architecture and related concepts underlying client installation, including remote client installation in accordance with various aspects of the present invention, while FIGS. 15 - 25 provide logically interconnected flow diagrams generally describing how the architecture is utilized for client installation. Beginning at FIG. 2, there is shown a number of discovery data records (DDRs) 60, which represent resources found on a network via various network resource discovery techniques. Many such network resource discovery techniques are known, and thus are not described in detail herein, except to note that machines connected to a network may be found via network resource discovery, and the information about those machines may be stored in the DDRs 60 or some other format. For example, DHCP servers may be polled as part of network discovery to find out about the machines of which the DHCP servers are aware, and similarly, a domain controller, (a domain can span multiple physical locations or sites), which has knowledge of machines registered therewith, may be polled. Network resource discovery uses these and other sources to try to figure out which machines are present



in a network, possibly attempt to contact the machines (e.g., via SNMP) for more information, and, in at least one implementation, produces DDRs representing those machines.

As shown in FIG. 2, a discovery data manager 62 associated with a parent (primary) site 64 and/or one or more child (secondary) sites 66, receives the DDRs as they are being discovered. The discovery data manager 62 places these in a Systems Management Server (SMS) database 68 that is associated with the parent site 64. If the database 68 already has a record for the same machine, the discovery data manager 62 merges the data (which may be different, depending on how discovered) therein and preserves the relevant information. Note that secondary sites 66 do not include an SMS database, and use the primary site to provide some of the data discovery manager processing, but for purposes of the present invention may be considered conceptually similar to primary sites.

FIG. 3 provides a representation of components underlying an alternative type of discovery, client logon discovery, that may produce DDRs during execution of a client logon script. A logon discovery manager 70 obtains dynamic configuration data via a site control file 72 including a list 74 identifying which domains have been configured to perform logon discovery.

From that list 74, along with some static data from a static configuration file 76, the logon discovery manager 70 produces a merged configuration file 78, which is fed along with data from a static logon file 80 and the site control file 74 into  
5 a logon server manager 82.

FIG. 4 represents how the logon server manager 82, running on a site (server) ABC, configures primary domain controllers 84 and 86 of Domain A and Domain B, respectively, to prepare the controllers 84 and 86 to run logon discovery.

10 Note that domains also include backup domain controllers, labeled "BDC" in FIG. 4, that replicate primary domain controller information. Preparing the domain controllers 84 and 86 for logon discovery includes copying a logon script file, associated executables and other binaries to the domain  
15 controllers 84 and 86. As also shown in FIG. 4, another site (server) XYZ has another logon server manager 88 which coordinates with the logon server 82 to also prepare the primary domain controller 86 of Domain B for logon discovery. Note that a logon server manager (e.g., 82) of a site (e.g.,  
20 64) may prepare one or more domains. Once a domain controller has been configured for logon discovery, the domain controller is generally referred to herein as a logon point.

FIG. 5 represents the logon discovery from the



via assignment criteria, i.e., if a client has an IP address within an IP subnet listed for the site, then the client is part of that site. The data discovery manager 62 accesses the site control file 74 for the assignment criteria, and stores appropriate network configuration information in a file 100 in a site server inbox 102 of the site server 64. A second process shown in FIG. 6 is performed by a client installation data manager 104, which reads package definition files 106 in order to enable the binaries needed for client installation to get to appropriate servers (client access points, FIGS. 7 and 8 described below) for those clients. The client installation data manager 104, writes a client configuration file 108 and other files 110 and 112 for this purpose.

FIG. 7 shows three of the data files (100, 108 and 110) being copied from the site server inbox by the logon server manager 82 to the logon point 86 (via the SMS logon service 94) for installation. As described in more detail below, for installation, only the core bootstrapping files needed for initiating the client installation are copied to the logon point. A primary goal is to keep this part of the installation as fast and small as possible, since this part of the installation needs to be done by a machine having administrator rights, and any network communication with such

machines should be kept small because for security reasons, only a small, physically secured number of administrative-level machines should be in a network.

As a secondary part of a client installation, a client  
5 access point (e.g., 114) provides the bulk of the installation data, as described below. Client access points are servers designated by the administrator via which clients may download relatively large amounts of data, including the larger portions of the client installation data, thereby removing the  
10 majority of the installation workload from the site servers / logon points. To further distribute workload, a client may be given a list of several client access points from which to download data, one of which the client selects (possibly randomly). As shown in FIG. 8, the configuration and  
15 installation data in the files 100, 108 and 110, and the file 112 (including the large client component package data) is copied from the site server to a service 116 of the client access point 114 via an inbox manager 118.

FIG. 9 is an installation process that is essentially  
20 identical to the discovery process described above with reference to FIG. 3. Thus, the site control file 72 is accessed to provide the list 74 identifying which domains have been configured to perform logon installation to a logon

installation manager 120. From that list 74, along with static installation data 122, the logon discovery manager 70 produces a merged installation file 124, which is fed along with data from a static logon file 126 and the site control  
5 file 74 into the site's logon server manager 82.

At this time, the various network servers are readied for client installations. One possibility is that the client has administrator (or other sufficient security) rights, in which event the client is able to directly obtain the SMS client  
10 service 128. More particularly, as represented in FIG. 10, the client gets assignment data and core installation files from the logon point 86, and then, via the administrator-level client's logon script (or SMSMAN.EXE) 90, an install service of the client directly installs the SMS client service 128 and  
15 other core components (FIG. 13) from the CAP. Details of the installation are described below with reference to the flow diagrams of FIGS. 14 - 25.

In accordance with one aspect of the present invention and as generally represented in FIG. 11, clients that do not  
20 have the rights needed for directly installing the SMS client service are instead able to install the service via a client configuration request (CCR) 130. To this end, the client logon script (or SMSMAN.EXE) 90 receives the assignment data



installation program. To this end, as represented in FIG. 12, the data discovery manager 62 examines DDRs 60 as they are discovered to determine which ones correspond to discovered machines that fit the criteria for being clients, i.e., which should be clients, and can be made clients. For example, such machines should not already be known to be clients, need to fit within the boundary of a subnet of the site, have the appropriate operating system (e.g., Windows® 2000) for the machine to be a client, and so forth, (as further described below with reference to FIG. 15).

If the machine identified in a DDR is an appropriate candidate to be a client, the discovery data manager 62 creates a CCR 130 (like the one the client can create during logon) on its behalf, and places it into a CCR queue 134 or the like. From there, the client configuration manager 132 takes the CCR 130, and, if the client configuration manager 132 can connect to the machine and the machine can be made a client, the client configuration manager 132 at the site installs a remote bootstrap service 136 (e.g., comprising two executable files described below) on the client machine. The client configuration manager 132 also provides client access point information (into the "client" machine's registry) and, by registering the bootstrap service in the client registry as



a service, causes a service manager (NTService) to start the remote bootstrap service 136.

The remote bootstrap service 136 contacts the client access point (e.g., 114) to install the client service 128 on the machine, whereby the machine essentially becomes a client. Also, as described below, the client configuration manager 132 may mark the CCR 130 to indicate "bootstrap started" and place it into a secondary retry queue 138, where it will later dequeue the CCR to ensure that the remote bootstrap service 136 has acted successfully, and if not, attempt to cause the install again. The client configuration manager 132 also may put the CCR 130 into the retry queue 138 if it is unable to connect to the machine and install the remote bootstrap service 136 thereon.

FIG. 13 shows a number of client components, including the remote bootstrap service 136 and core components 140 such as the client service 128. These and other components shown in FIG. 13 are further described below with reference to the flow diagrams of FIGS. 14 - 25.

Turning to the flow diagrams, FIG. 14 shows general steps essentially performed by the data discovery manager 62, although step 1400 is not ordinarily performed by the data discovery manager 62, but rather represents the running (e.g.,

by an administrator) of one or more discovery methods that generate the data discovery records 60 and other information for discovered network resources. From the information, at step 1402, a process of the data discovery manager 62 (the DDM process) enumerates those computers assigned to the current site that have an appropriate operating system (e.g., Windows® NT or Windows® 2000), and creates a DDR for each such computer (if one does not already exist). Via steps 1404 - 1408, the DDM process selects each enumerated DDR and determines whether to create a CCR therefor, as generally represented in FIG. 15.

As generally described above, a machine having a DDR is generally tested for meeting certain criteria before the machine can become a candidate for remote client installation. Steps 1500 - 1508 represent the testing for that criteria by the DDM process, although as will be understood, the tests may be performed in a different order, and additional tests or a lesser amount of tests may be performed. Moreover, the tests need not be necessarily performed, e.g., some are for efficiency and are thus beneficial, but not required. In any event, step 1500 tests whether the machine name in the DDR is on a list of excluded machines (e.g., servers), which an administrator decides so that inappropriate machines (e.g., certain servers) are not made clients. The list of excluded

servers is stored in the site server registry key

HKEY\_LOCAL\_MACHINE\SMS\Components\SMS\_Discovery\_

Data\_Manager\Exclude Servers. If excluded, the process

branches ahead to step 1514, wherein if logging is enabled,

5 information about the attempt is logged at step 1516. If

logging is not enabled, or after logging is performed at step

1516, the DDM process returns to the steps in FIG. 14 to

select and process the next DDR, or if none remain for

processing, end the process, (e.g., sleep until a DDR is

10 available). If the machine is not excluded at step 1500, step

1502 is executed to perform the next test.

Step 1502 tests whether the resource architecture is set  
to "System," (as opposed to IP Network, User or User Group).

If so, the next test is performed, otherwise this DDR is not

15 considered a candidate and as described above, the next DDR,

if any, is selected (step 1408) after possibly logging the

attempt (step 1516).

The next test at step 1504 evaluates the operating system  
for appropriateness, which in one preferred implementation

20 requires that the operating system be Windows® 2000 or

Windows® NT. Also, if the operating system is not known from

the DDR, the attempt may be made anyway to see if the machine

can become a client, in which event the DDM process performs

the next test on the DDR by branching ahead to step 1506. Otherwise, the test fails, and the DDM process branches to step 1514 as described above.

Step 1506 tests whether the SMS database 68 indicates  
5 that the client service 128 has already been installed on the computer system. If so, the DDM process rejects this DDR as a candidate for remote installation, by branching to step 1514 as described above. If not, another test is performed at step 1508 to determine whether remote client installation is  
10 enabled, i.e., in an SMS administrator console. If not, the DDR is further evaluated at step 1510 to determine whether the discovery agent that created the DDR was "Windows NT Server Discovery," in which event the remote installation attempt should still be made for this machine. If the DDR evaluation  
15 for either remote install enable (step 1508) or the discovery agent (step 1510) is passed by the selected DDR, the DDM process continues to step 1512 where a CCR is created based on the currently selected DDR, and placed in the primary CCR queue (\\SMS\\Inboxes\\Ccr.box). The DDM process then returns  
20 to FIG. 14 to similarly process any other DDRs.

FIG. 16 generally represents a process of the client configuration manager 132 (CCM process), beginning at step 1600 wherein the CCM selects a CCR from the CCR queue 134 or

the CCR retry queue 138. Note that if the CCR is marked as being one representing an already started bootstrap, the bootstrap is checked, and if successful, the CCR is discarded and another one is selected, and if the bootstrap is not  
5 successful, the mark is effectively removed from the CCR and the CCM process restarted therefor. Steps 1602 - 1616 relate to CCRs that have not been marked or have had the mark removed therefrom. Also, note that the CCM process may only process CCRs from the retry queue 138 after some interval (e.g., once  
10 per hour), and may dynamically adjust (a configurable) number of threads used thereby depending on the size of the queues 134, 138.

Step 1602 tests whether the CCM process can connect to the client computer. If not, step 1602 branches to step 1604  
15 where the CCR is evaluated against a retry threshold, e.g., in one implementation, the CCM will retry CCR processing for up to seven days, the retry threshold. If the threshold has not been exceeded, the CCR is placed into the retry queue 138 for a later attempt, which may be delayed for some time interval  
20 (e.g., such that the retry queue is processed once per hour) so as to not continuously retry this CCR. If the retry threshold has been exceeded, this CCR is essentially rejected, and the CCR can log the thresholding failure attempt if

enabled to do so (steps 1612 and 1614). Note that a message may be sent to an administrator at any point wherein installation fails, such as when the CCM process cannot connect to the client computer. This message may be disabled  
5 for a period of time (e.g., the first twenty-four hours), to give remote installation several chances before notifying an administrator. Further, note that the various types of failures may have different messages sent and/or information logged therefor, and that the type of failure (e.g., no  
10 communication versus a security problem) may be a factor in setting the retry threshold, retry interval and/or the initial delay time before sending a message.

Returning to step 1602, if a connection with the client is established, step 1608 is executed, which checks for the  
15 presence of certain registry keys on the client (HKEY\_LOCAL\_MACHINE\SOFTWARE\Microsoft\SMS Client\Configuration\Client Application Launchers\Client Configuration Installation Manager\Heartbeat and HKEY\_LOCAL\_MACHINE\SOFTWARE\Microsoft\SMS Sites\Site List) which indicate that the client has  
20 already been installed. If the registry keys are already on the client, and the client is assigned to the site (step 1610), then the CCM process rejects this CCR by branching to step 1612 as described above, wherein if logging is enabled, a

message essentially indicating this already installed state will be logged therefor at step 1614. If the keys are not on the machine, or are present but the client is not assigned to this site, then step 1616 is executed to begin the  
5 installation.

At step 1616, a component (e.g., ccm.dll) of the CCM process of the site server copies and updates the bootstrap service 136 to the client computer, comprising two files, Ccmcore.exe and Ccmbtldr.exe.

10 Step 1618 is performed by the client machine's bootstrap service (i.e., ccmbtldr, and not the site's CCM process), which (by calling Ccmcore.exe) extracts network abstraction layer (NAL) Files 142 (FIG. 13), and registers a NAL path to the client access point 114. The client bootstrap process  
15 continues thereafter at step 2210 of FIG. 22 as described below.

FIGS. 17 - 25 provide a general description of the logon discovery and installation process. Note that part of this installation process is common to the remote client  
20 installation (no logon necessary) process of the present invention, as described beginning at step 2210 of FIG. 22. Logon discovery and installation aspects will only be generally described herein for informational purposes. Step

1700 of FIG. 7 represents a user logon, at which time the logon script starts (step 1702). If a program (Slownet.exe) used for logon is located on the client, step 1704 causes it to be locally run it at step 1706, otherwise steps 1708 - 1710 are executed, in which a server program (snboot.exe) is run to load the correct version of Slownet.exe onto the client, (depending on the client's operating system), and then run it from the client. Step 1712 tests the network speed, which continues the logon discovery and installation process if greater than forty kilobits per second, cancels it if less, and if it does not know, continues the process via step 1714 if non-RAS (dial-up) or cancels it if RAS is detected.

If the process continues, step 1800 looks for a first SMS boot program, SMSboot1.exe (Boot1), on the client, and runs it at step 1802 if found locally. Otherwise, step 1804 runs Boot1 from the logon point, e.g., the domain controller 86 that has been configured for logon discovery. As generally represented in step 1806, Boot1 locates the local SMS directory, identifies the operating system to determine a correct version of Boot32wn.exe (Bboot2), checks the local version of Boot2 to determine if it needs to be copied or updated from the server, and creates a Boot2 ".ini" file with Boot2 parameters (e.g., the path to the logon point and a



client installation directory). Boot1 then starts Boot2,  
after which Boot1 terminates.

FIG. 19 generally represents the steps performed by  
Boot2, beginning at step 1900 wherein the parameters saved by  
5 Boot1 are read from the .ini file, and then the .ini file is  
deleted. If the computer is a Windows® NT / 2000 computer  
(step 1902), a second copy of Boot2 is started and the first  
copy of Boot2 is terminated to free the command shell window  
from waiting on subsequent processes.

10 At step 1906, Boot2 reads a file, Win\*.tcf (which  
includes data discovery properties to be discovered) from the  
logon point 86, copies binary executable files including  
SMSboot1.exe and CliCore.exe from the logon point to the  
client's SMS core directory, copies, modifies and renames  
15 Win\*.tcf (to Temp.tcf) to the client, and creates an SMS  
unique identifier if one does not already exist in the client  
registry.

FIG. 19 continues to step 2000 of FIG. 20 which  
represents the running of another client component to perform  
20 logon discovery, Cliex32.dll, which reads the Temp.tcf file to  
get a list of the discovery data properties that should be  
discovered. Cliex32.dll then collects discovery data into a  
DDR by making a separate call for each property to be

discovered, and creates a DDR on the client with the property names and values therein. Then, at step 2002, if logon discovery is enabled, (in the SMS administrator console), the DDR is copied to a server at step 2004. Step 2006 then tests whether the client is assigned to any sites, and if not, the process ends, otherwise the process continues to step 2100 of FIG. 21.

At FIG. 21, Boot2 resumes by calling a client core installation program (Clicore.exe) to install the files needed for client installation. For each assigned site, the client access point list is read from the server, the client installation configuration is read from the server, and the list of client access points in the client registry is updated based on the client access point list. If at step 2104 the client service is already installed (with Ccim32.dll registered to start), the process continues to FIG. 23 as described below. If not, step 2104 branches to step 2106 to determine whether the user has local administrator rights, whereby if so, the Boot2 process similarly continues to FIG. 23 as described below. If not, however, the process (via Cliex32.dll) creates a CCR on the client access point for this computer system.

FIG. 22 generally describes the handling of a CCR to

perform client installation, following the CCR having been copied from the client access point (e.g., 114) to the site server 64 at step 2200. At step 2202, the site server, via a component (Ccm.dll) of the CCM process, attempts to connect to the client. If unsuccessful, the process stops, e.g., the CCR 130 is put into the retry queue 138 (FIG. 12) unless the threshold retry time is achieved, as described above with reference to FIG. 16. If the connection is successful, at step 2206 the CCM process copies and/or updates the bootstrap service (Ccmcore.exe and Ccmbtldr.exe) on the client, and then starts the bootstrap process. The client machine's bootstrap service (Ccmbtldr) performs step 2208, which calls Ccmcore.exe to extract the network abstraction layer (NAL) Files 142 (FIG. 13), and register a NAL path to the client access point 114. At this time, the logon installation procedure has reached the same point as the above-described remote client installation procedure.

At step 2210, the client bootstrap service continues by copying and/or updating the Clicore.exe and Ccmboot.exe files from the client access point 114, and then starting Ccmboot. As represented by step 2300 of FIG. 23, Ccmboot installs and starts the SMS client service 128, registers Ccim32.dll under the SMS client service (and records the action in the Ccim32

log), and terminates.

At step 2302, Ccim32.dll creates an SMS unique identifier if one does not already exist in the client registry, and at step 2304, continues the installation by looking to determine whether certain client base components 144 are installed. If already installed, step 2304 branches ahead to step 2310, otherwise Clicore.exe installs some remaining SMS core components at step 2306, and executes Mlaunch.dll at step 2308 to install the SMS base components APM and WMI. At step 2310, Ccim32.dll calls Cliex32.dll to get the list of discovery data from the .tcf file.

At step 2400 of FIG. 24, Cliex32.dll reads the Temp.tcf file to get a list of the discovery data properties that should be discovered, collects discovery data into a DDR, and creates a DDR on the client with the property names and values therein. Then, beginning at step 2402, for each listed site, the client assignment to that site is checked. If not assigned at step 2404, the site is removed from the client's site list at step 2406, and the process branches ahead to step 2418 which loops back until no more listed sites need to be checked.

If still assigned to the site, step 2404 branches to step 2408 where Cliex32.dll reads the CAPlist.ini file from the

logon server in order to update the list of client access points in the local client registry. Step 2410 is also executed to check the heartbeat interval, and, if a heartbeat DDR is needed (step 2412), Cliex32.dll determines a unique name for the DDR and copies the DDR to a DDR queue (Ddr.box) on the client access point 114. Step 2416 represents Cliex32.dll gathering client component advertisements from the site, and appropriately updating the client machine's site data files and registry information. Step 2418 then repeats the process for each site to which the client is assigned.

Lastly, FIG. 25 represents Ccim32.dll checking the status of each optional component for possible installation, updating or deinstallation thereof, and also checking whether the machine is still a client of an SMS site. If any optional component is assigned but not installed, an install command is submitted to the APM base component therefor. If it is installed, the component's version is checked, and if an older version is found, the process submits an upgrade command to APM, otherwise a verify command is submitted. If an optional component on the machine is not active for any site to which the client is assigned, the component is deinstalled. The activity is then logged in the client ccim32 log. Once the components have been checked, step 2502 checks to determine

whether the client is still assigned to an SMS site. If not,  
the Ccim32.dll removes the client's base components and ends  
the installation process. If still assigned to an SMS site,  
Ccim32.dll sleeps for a period of time (e.g., twenty-three  
5 hours) if all advertised components are installed, otherwise  
Ccim32.dll sleeps for a generally lesser period of time (e.g.,  
one hour if any errors or advertisements are pending.

As can be seen from the foregoing detailed description,  
there is provided a method and system for remote client  
10 installation of system management software. The method and  
system are automatic, and thus do not rely on user  
intervention. The method and system enable remote client  
installation in a manner that overcomes the problems in the  
prior art.

15 While the invention is susceptible to various  
modifications and alternative constructions, certain  
illustrated embodiments thereof are shown in the drawings and  
has been described above in detail. It should be understood,  
however, that there is no intention to limit the invention to  
20 the specific forms disclosed, but on the contrary, the  
intention is to cover all modifications, alternative  
constructions, and equivalents falling within the spirit and  
scope of the invention.

WHAT IS CLAIMED IS:

1. In a computer network, a method for installing software onto a remote client machine, comprising:

initiating a connection at a server to the client

5 machine;

transmitting an installation service from the server to the machine; and

executing the installation service.

10 2. The method of claim 1 wherein initiating a connection to the client machine includes discovering the client machine.

15 3. The method of claim 2 further comprising, evaluating discovery information associated with the client machine.

4. The method of claim 3 wherein the discovery information associated with the client machine is evaluated against a set of rules.

20

5. The method of claim 3 wherein evaluating discovery information associated with the client machine includes determining whether the client machine is included or excluded.

5

6. The method of claim 3 wherein evaluating discovery information associated with the client machine includes checking the operating system of the machine.

10 7. The method of claim 3 wherein evaluating discovery information associated with the client machine includes checking at least one property of the machine.

15 8. The method of claim 3 wherein evaluating discovery information associated with the client machine includes determining whether certain software is already installed on the machine.

20 9. The method of claim 1 wherein initiating a connection to the client machine includes creating a configuration request for the client machine.



10. The method of claim 9 wherein initiating a connection to the client machine includes processing the configuration request.

5 11. The method of claim 9 further comprising queuing the configuration request.

10 12. The method of claim 11 wherein initiating a connection to the client machine includes dequeuing and processing the configuration request.

15 13. The method of claim 1 wherein the installation service comprises a bootstrap service, and wherein executing the installation service includes running the bootstrap service to connect to the client machine to another server, and transmitting additional software from the other server for installing on the client machine.

20 14. The method of claim 13 further comprising, installing optional components on the client machine by executing the additional software.

15. A computer-readable medium having computer-executable instructions for performing the method of claim 1.

16. In a computer network, a system for selectively  
5 installing management software onto remote client machines,  
comprising:

a data manager for evaluating information associated with  
discovered machines, and for selecting one of the remote  
client machines as a selected client machine;

10 a configuration manager for initiating a connection to  
the selected client machine; and

an installation service transmitted by the configuration  
manager to the selected client machine, the installation  
service installing at least part of the management software on  
15 the selected client machine.

17. The system of claim 16 wherein the data manager  
selects the client machine by evaluating discovery information  
associated with the client machine against criteria.

20

18. The system of claim 17 wherein at least part of the  
discovery information associated with the client machine is  
maintained in a data discovery record.

19. The system of claim 16 wherein the data manager produces a configuration request for the selected client machine, and wherein the configuration manager receives the  
5 configuration request.

20. The system of claim 19 wherein the configuration request comprises a client configuration record.

10 21. The system of claim 19 wherein the configuration request is placed in a queue by the data manager and removed from the queue by the configuration manager.

15 22. The system of claim 21 further comprising a retry queue.

20 23. The system of claim 16 wherein the installation service comprises a bootstrap service for installing additional management software on the selected client machine.

24. The system of claim 23 wherein the additional management software is downloaded from a client access point.

25. The system of claim 23 wherein the bootstrap service is configured to connect the client machine to another server.

26. The system of claim 25 wherein the other server  
5 transmits additional software for installing on the client machine, and wherein the additional software installs optional components on the client machine.

27. In a computer network, a method for installing  
10 management software onto a remote client machine, comprising:  
attempting to initiating a connection at a server to the client machine, and if successful:  
transmitting an installation service from the  
server to the client machine, and executing the  
15 installation service;  
and if not successful:  
secondarily attempting to initiate a connection  
at the server to the client machine, and if  
successful, transmitting an installation service  
20 from the server to the machine, and executing the installation service.

28. The method of claim 27 further comprising,  
evaluating discovery information associated with the client  
machine.

5        29. The method of claim 27 wherein attempting to  
initiate a connection to the client machine includes,  
associating a configuration request with the client machine.

10       30. The method of claim 29 wherein attempting to  
initiate a connection to the client machine includes queuing  
the configuration request, dequeuing the configuration  
request, and processing the configuration request.

15       31. The method of claim 30 wherein the attempt to  
initiate a connection to the client machine is unsuccessful,  
and further comprising, secondarily queuing the configuration  
request.

20       32. The method of claim 31 wherein secondarily  
attempting to initiate a connection to the client machine  
includes dequeuing the secondarily queued configuration  
request.

33. The method of claim 29 further comprising, modifying the configuration request by writing data thereto indicative of installation service executing on the client machine.

5        34. The method of claim 33 further comprising, queuing the configuration request having the data written thereto.

35. The method of claim 34 further comprising, dequeuing the configuration request having the data written thereto,  
10 determining if the installation service executed successfully, and if not, reattempting execution of the installation service.

36. The method of claim 35 wherein reattempting  
15 execution of the installation service includes removing the data written to the configuration request.

37. The method of claim 36 further comprising queueing the configuration request having the data removed therefrom.

20

38. The method of claim 27 wherein the installation service comprises a bootstrap service, and wherein executing the installation service includes running the bootstrap service to connect to the client machine to another server,  
5 and transmitting additional software from the other server for installing on the client machine.

38. The method of claim 27 further comprising,  
installing optional components on the client machine by  
10 executing the additional software.

39. The method of claim 27 wherein secondarily attempting to initiate the connection includes delaying for a period of time.  
15

40. A computer-readable medium having computer-executable instructions for performing the method of claim 27.

41. A method for installing software onto a client machine, comprising:

determining whether a user that is logged onto the client machine has sufficient security rights, and if so:

5                   executing a process at the client machine to  
                  install the software;

and if not:

                  initiating a connection at a server to the  
                  client machine, transmitting an installation service  
10                  from the server to the client machine, and executing  
                  the installation service to install the software.

42. The method of claim 41 further comprising,  
evaluating discovery information associated with the client  
15                  machine.

43. The method of claim 41 wherein initiating a  
connection to the client machine includes associating a  
configuration request with the client machine.

20



44. The method of claim 43 wherein initiating a connection to the client machine includes, queuing the configuration request, dequeuing the configuration request, and processing the configuration request.

5

45. The method of claim 43 further comprising, modifying the configuration request by writing data thereto indicative of installation service executing on the client machine.

10 46. The method of claim 45 further comprising, queuing the configuration request having the data written thereto.

15 47. The method of claim 46 further comprising, dequeuing the configuration request having the data written thereto, determining if the installation service executed successfully, and if not, reattempting execution of the installation service.

48. The method of claim 41 wherein the installation  
service comprises a bootstrap service, and wherein executing  
the installation service includes running the bootstrap  
service to connect to the client machine to another server,  
5 and transmitting additional software from the other server for  
installing on the client machine.

49. The method of claim 48 further comprising,  
installing optional components on the client machine by  
10 executing the additional software.

50. A computer-readable medium having computer-  
executable instructions for performing the method of claim 41.  
15

## ABSTRACT

A method and system to remotely install management software on client machines of a network without requiring user-intervention such as a logon. A data discovery manager determines which discovered machines in a network should be configured for client installation, and queues a client configuration request (CCR) for each such machine. A client configuration manager dequeues each CCR, and attempts to establish a connection with the remote machine corresponding to the CCR. If successful, a bootstrap install service is downloaded to the client machine from a server having administrative rights, after which the bootstrap service is run to install the remainder of the management software on the client machine from a client access point server. If unsuccessful, retries may be attempted. Client machines having users with sufficient security rights may install the management software via a logon or other process at the client machine.



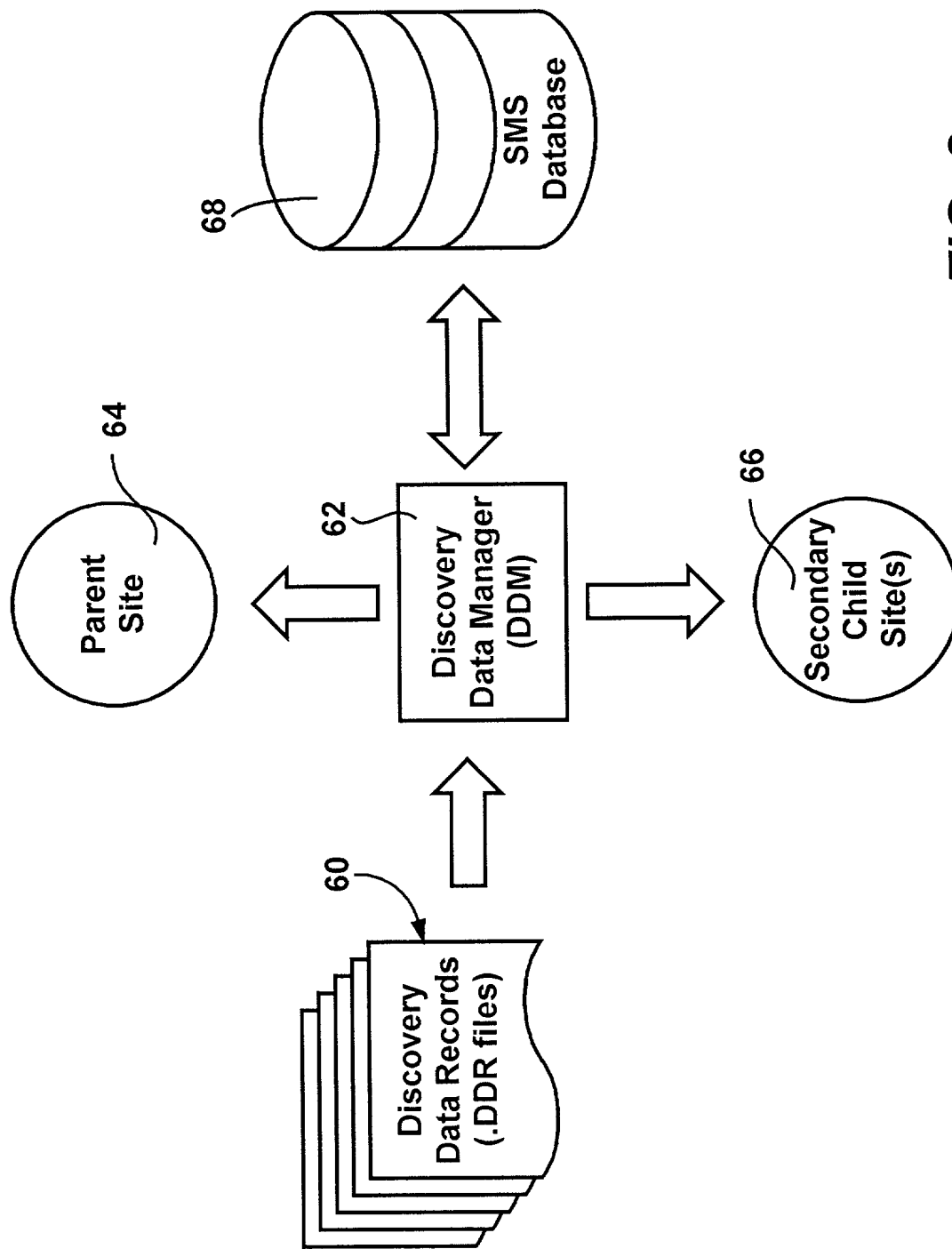


FIG. 2

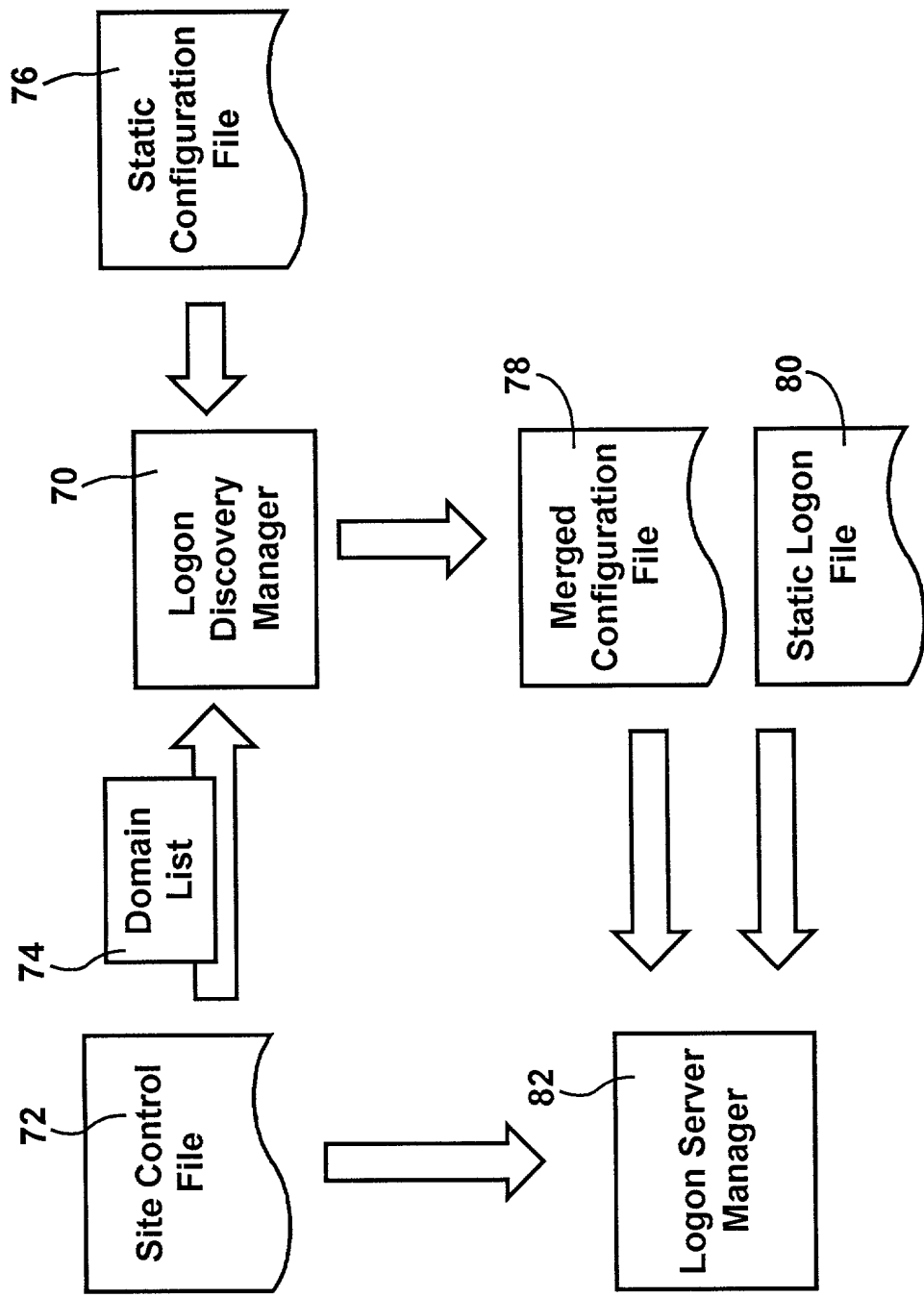


FIG. 3

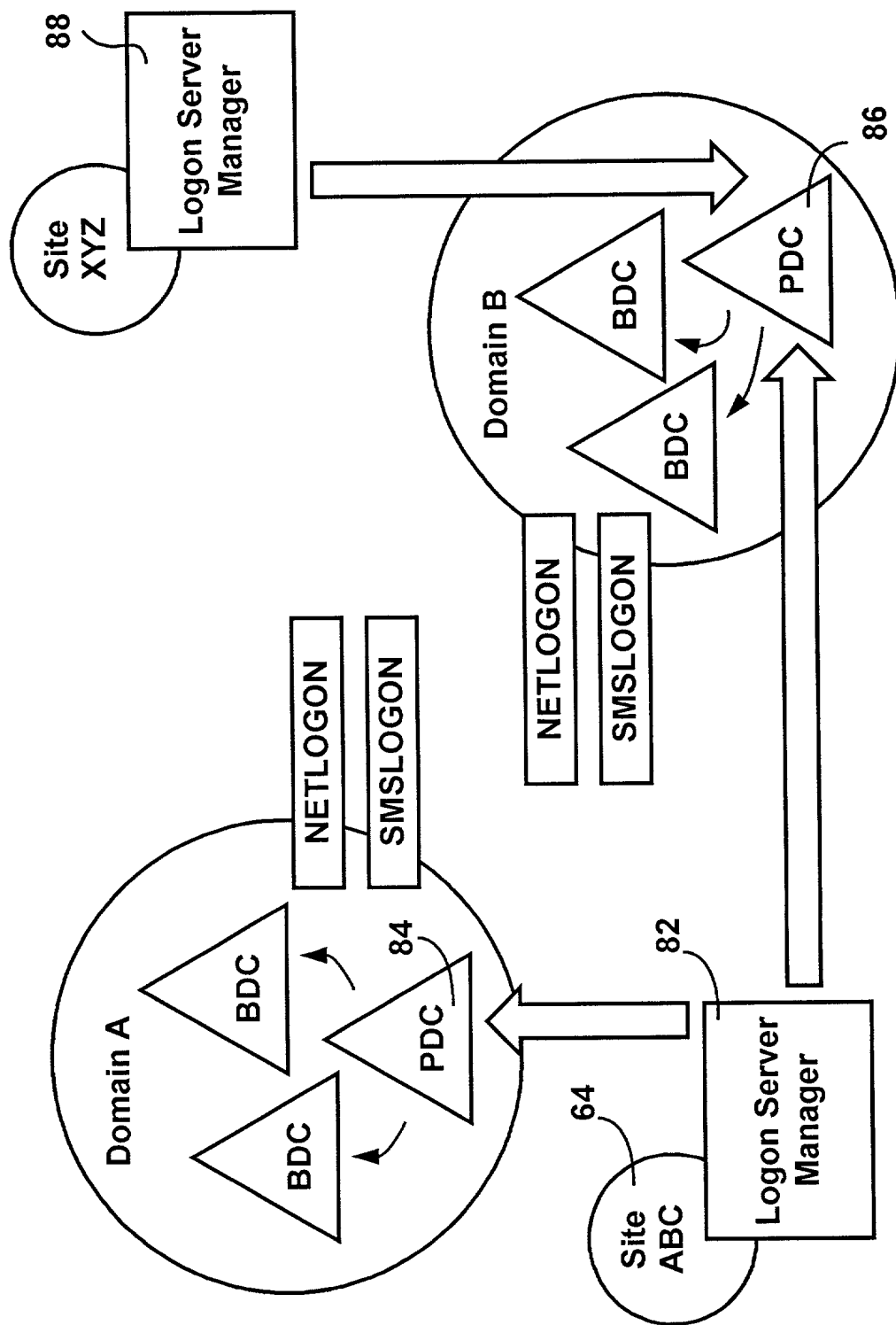


FIG. 4





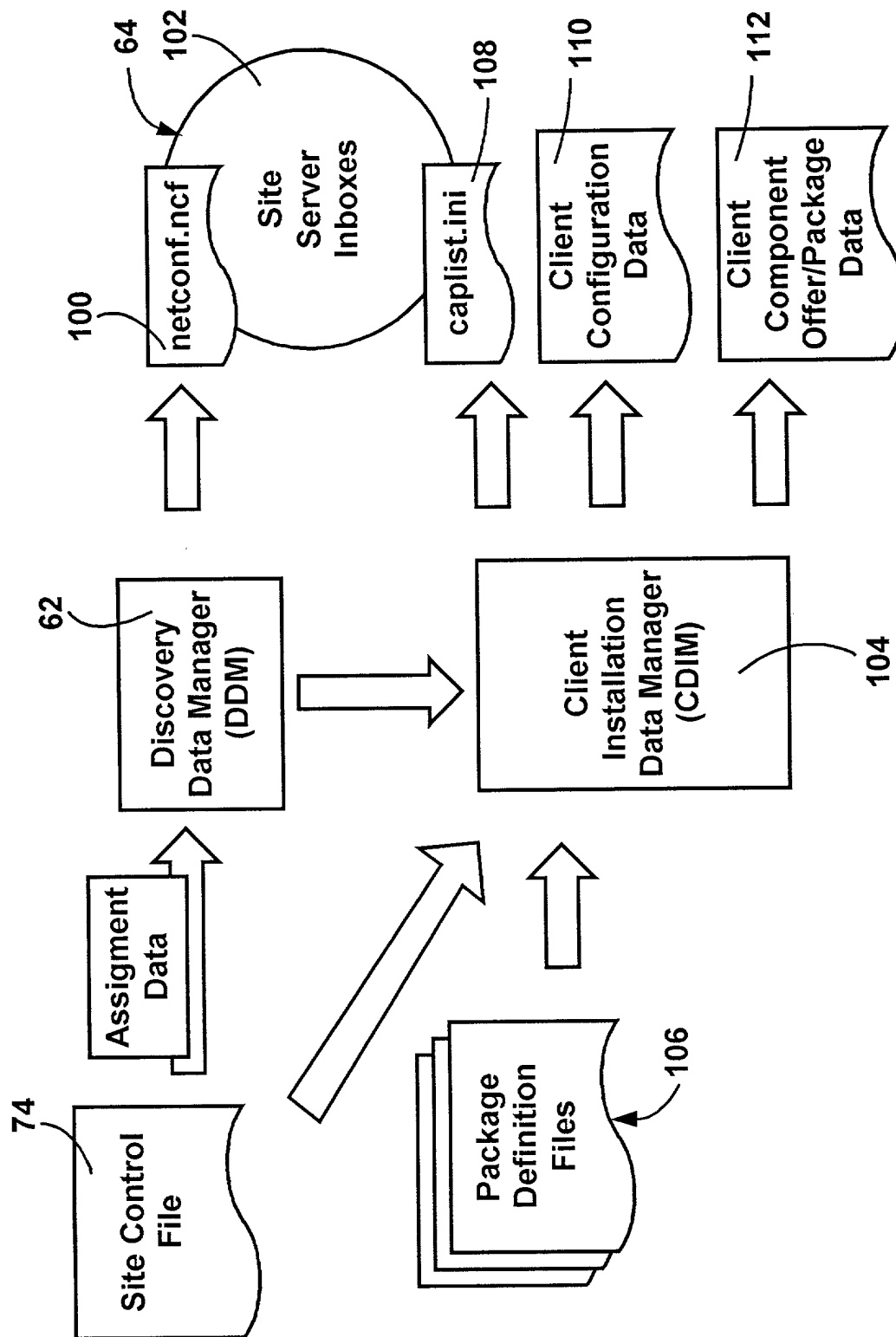


FIG. 6

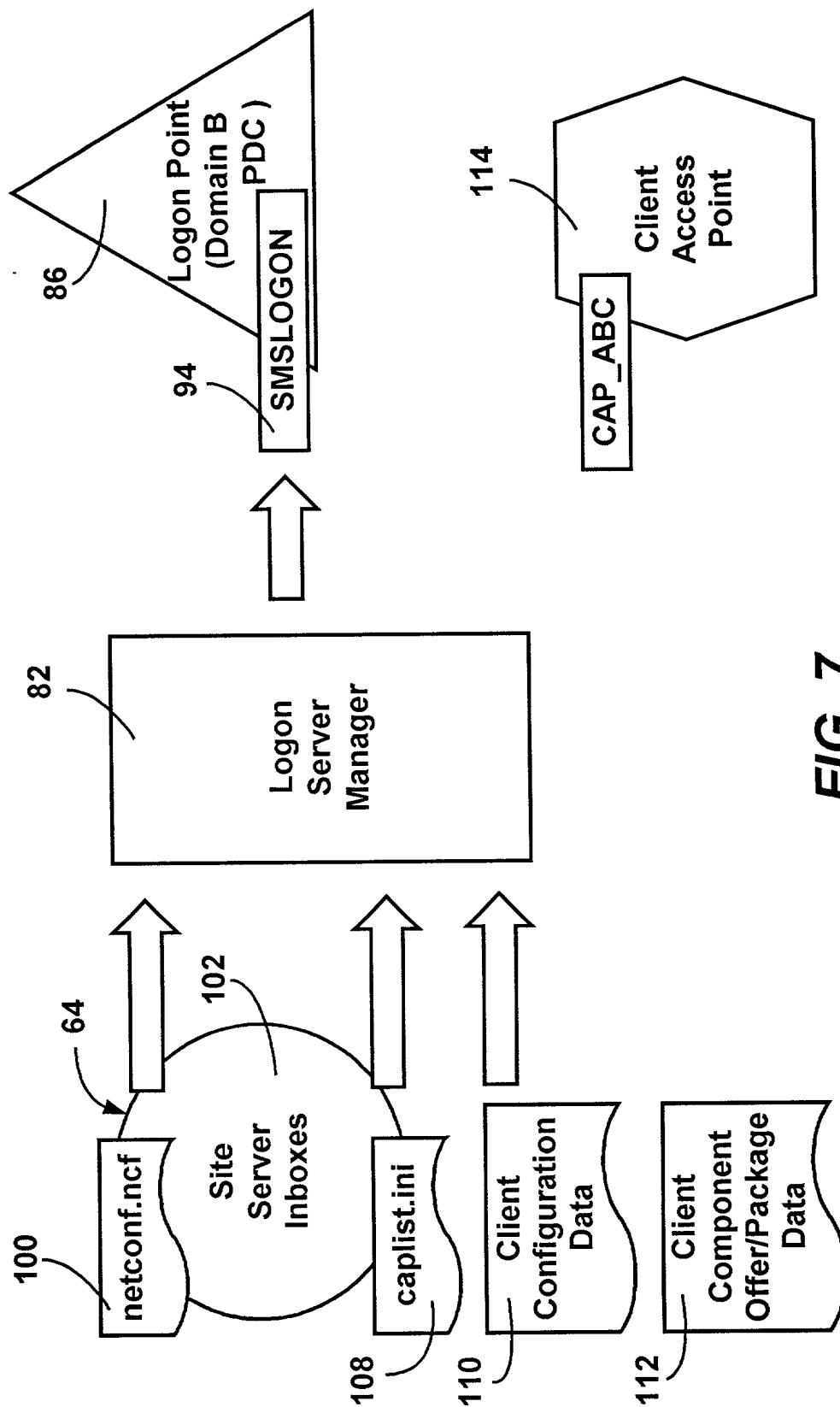


FIG. 7

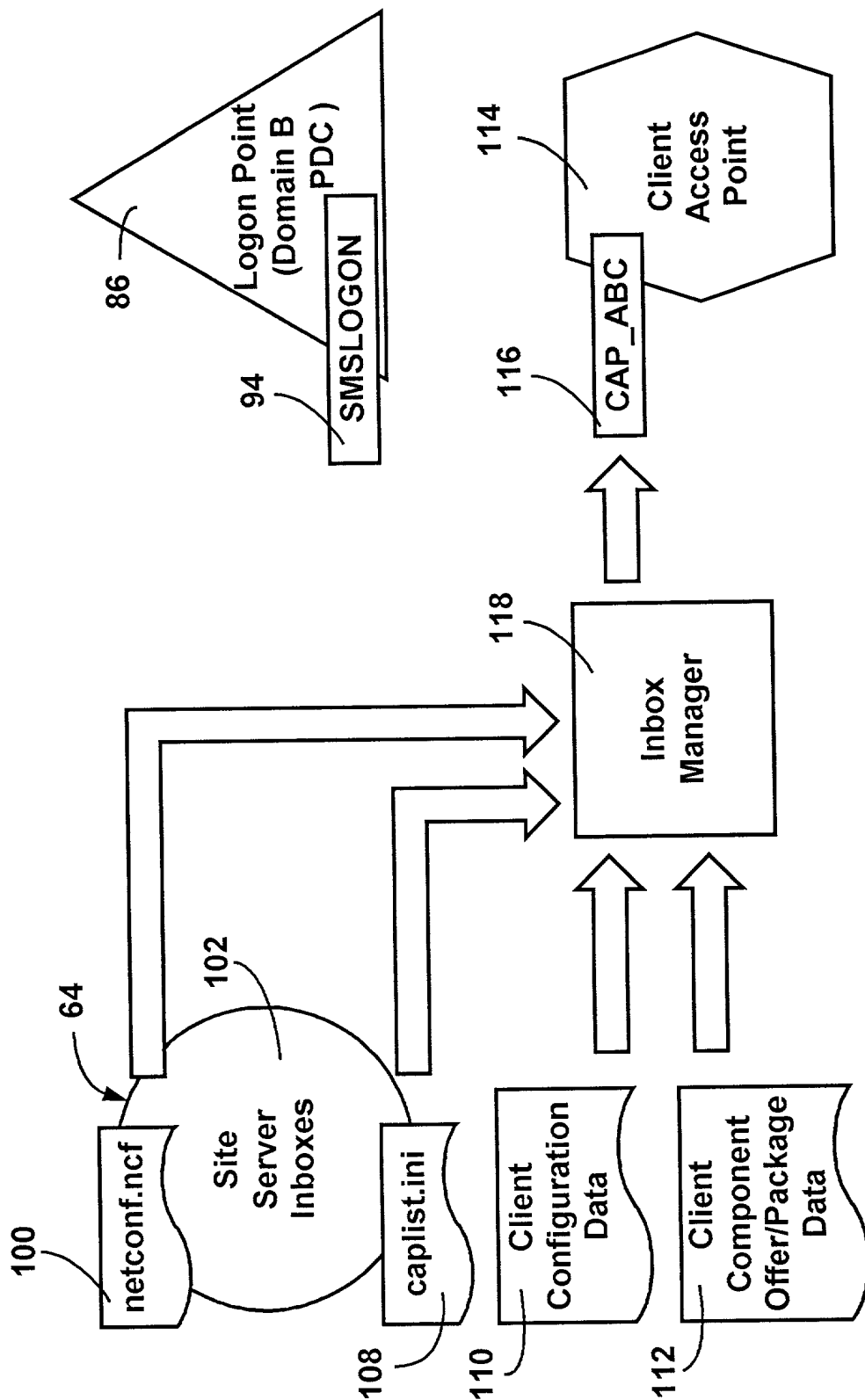


FIG. 8

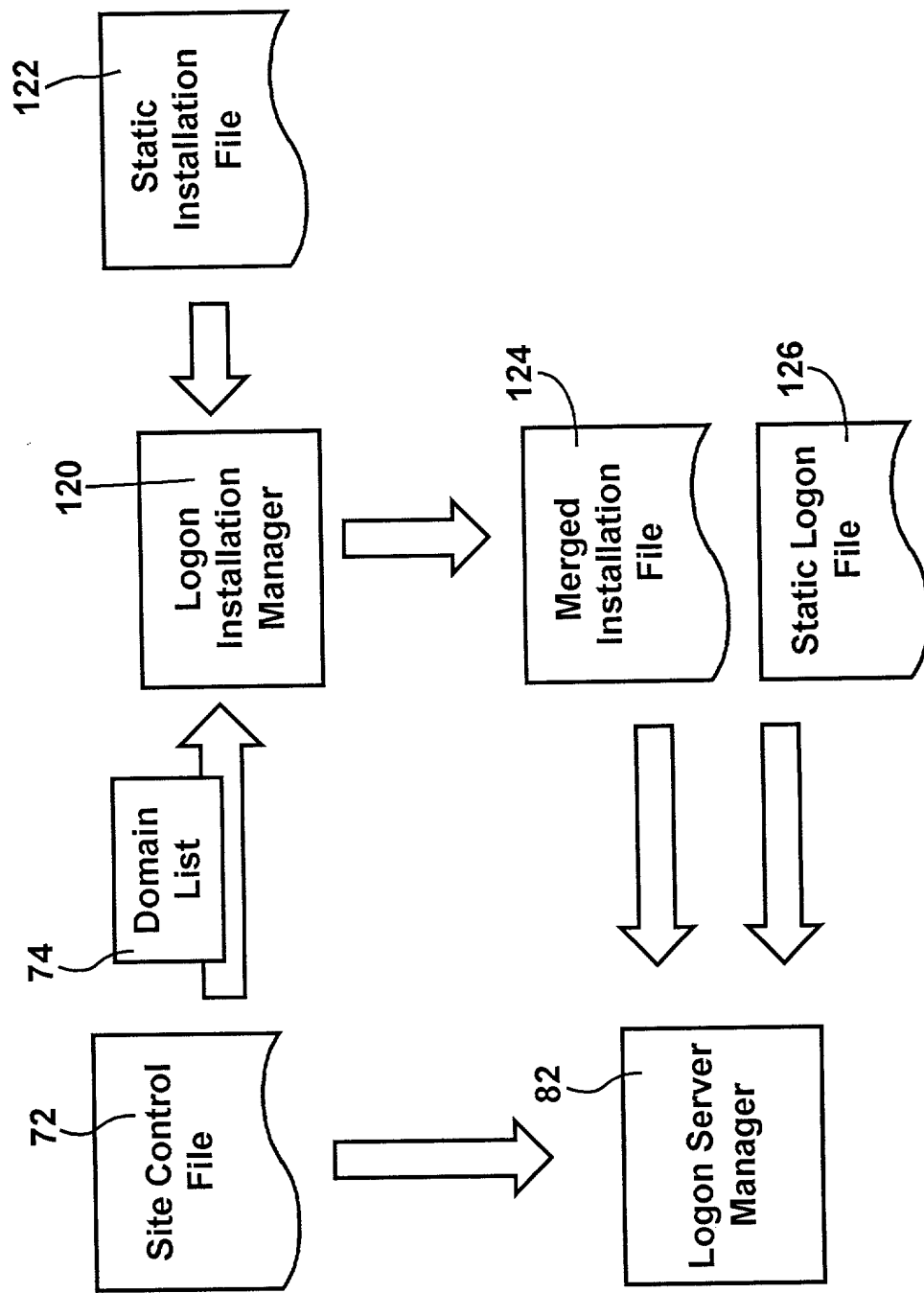


FIG. 9

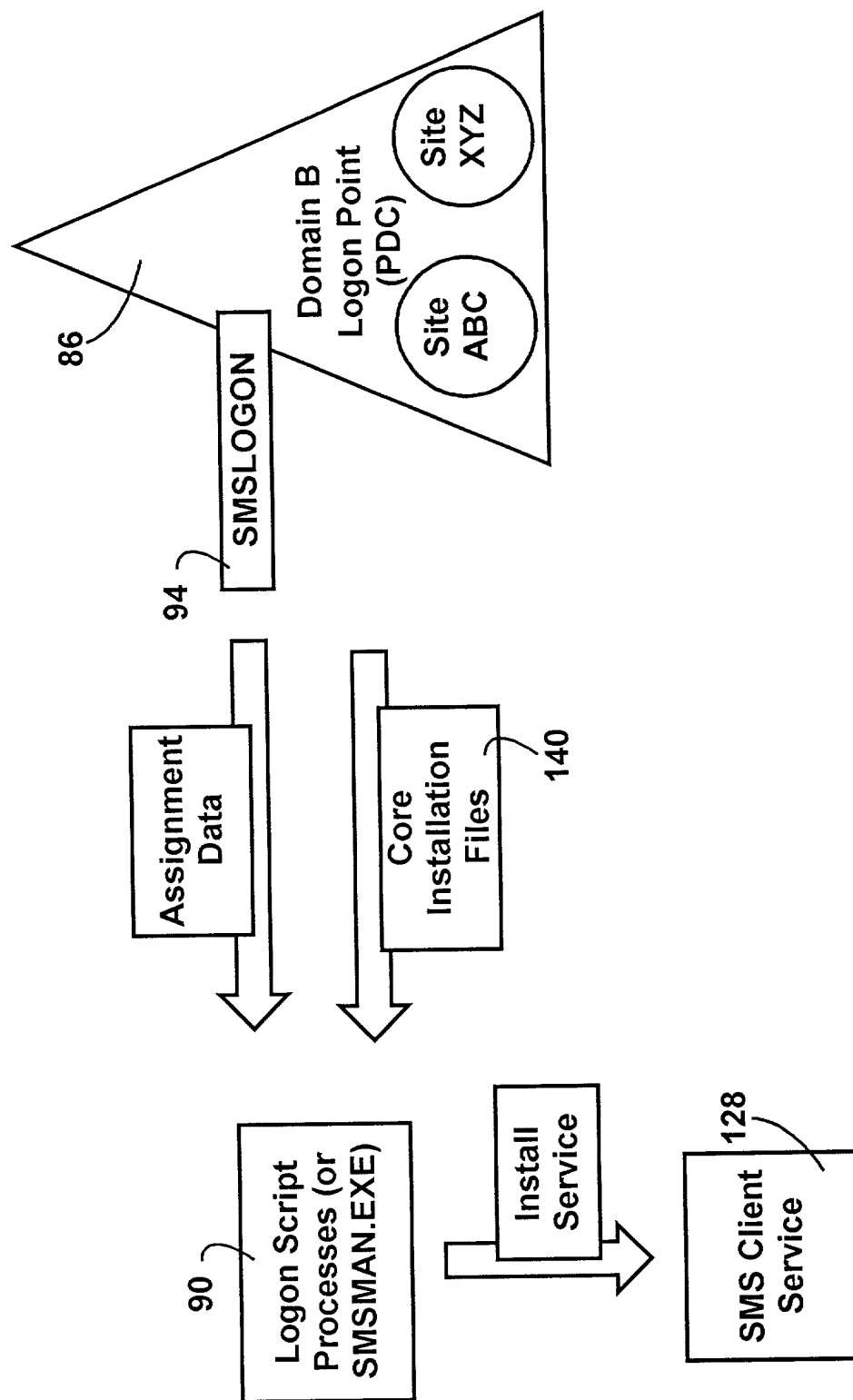


FIG. 10

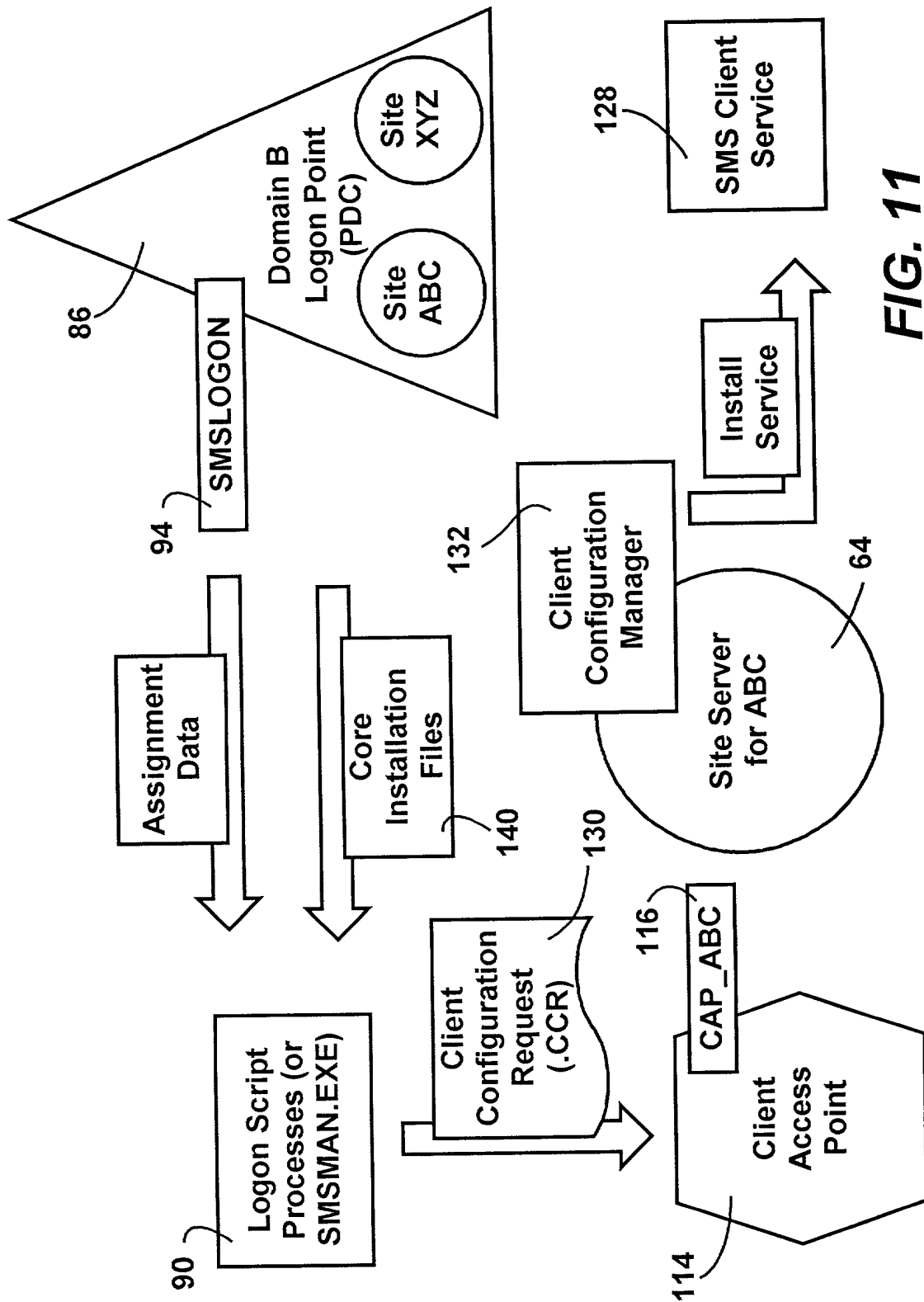
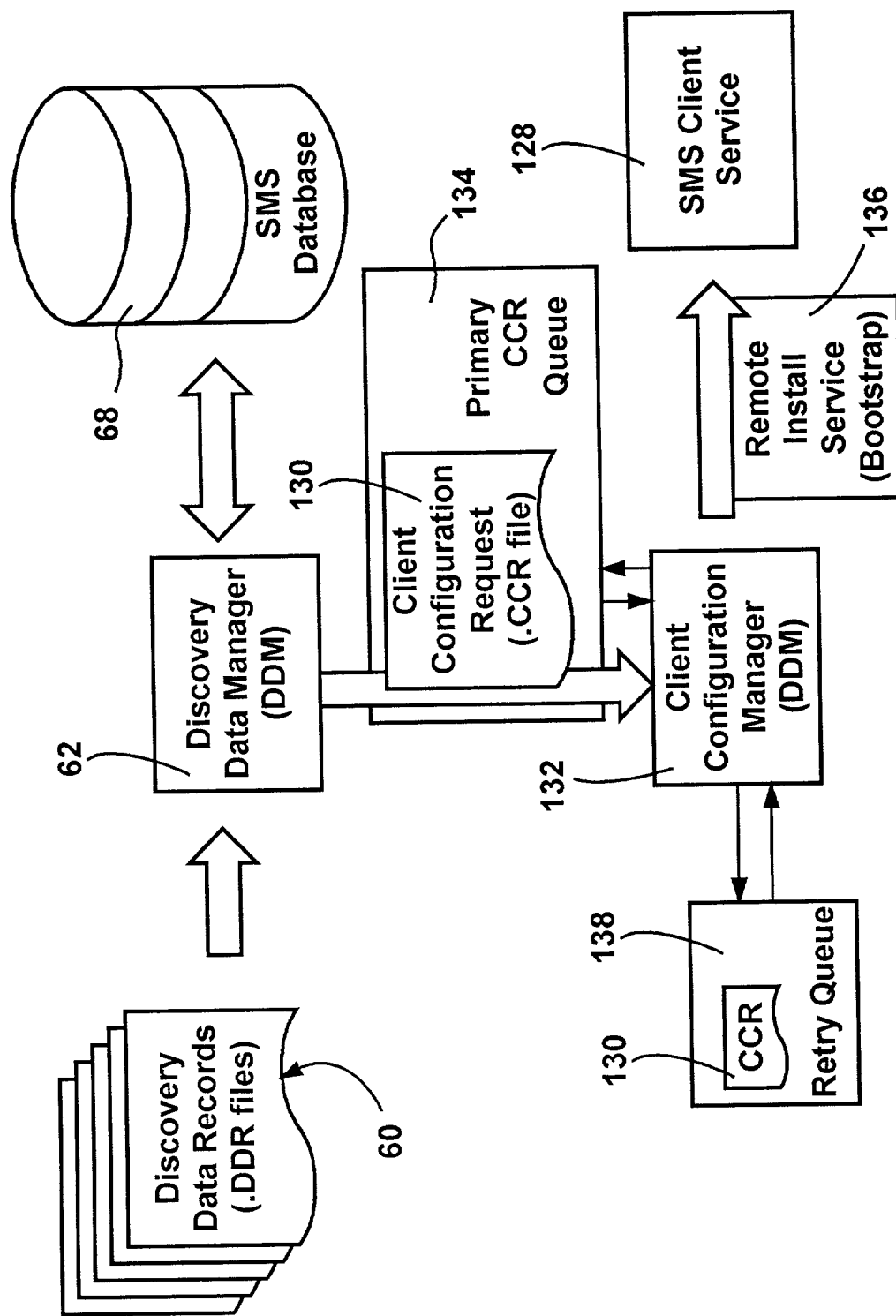


FIG. 11

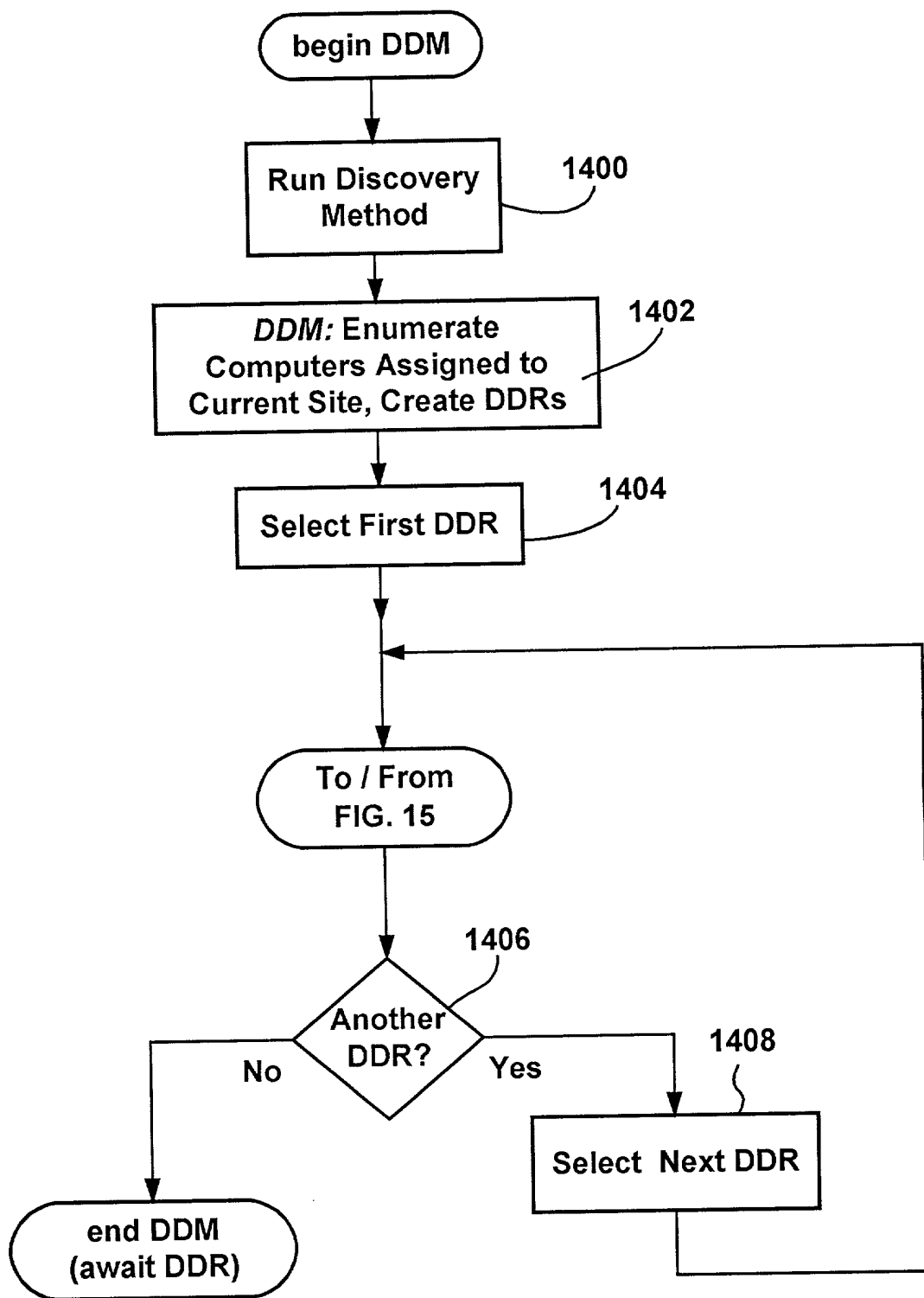


**FIG. 12**





**FIG. 14**





**FIG. 16**

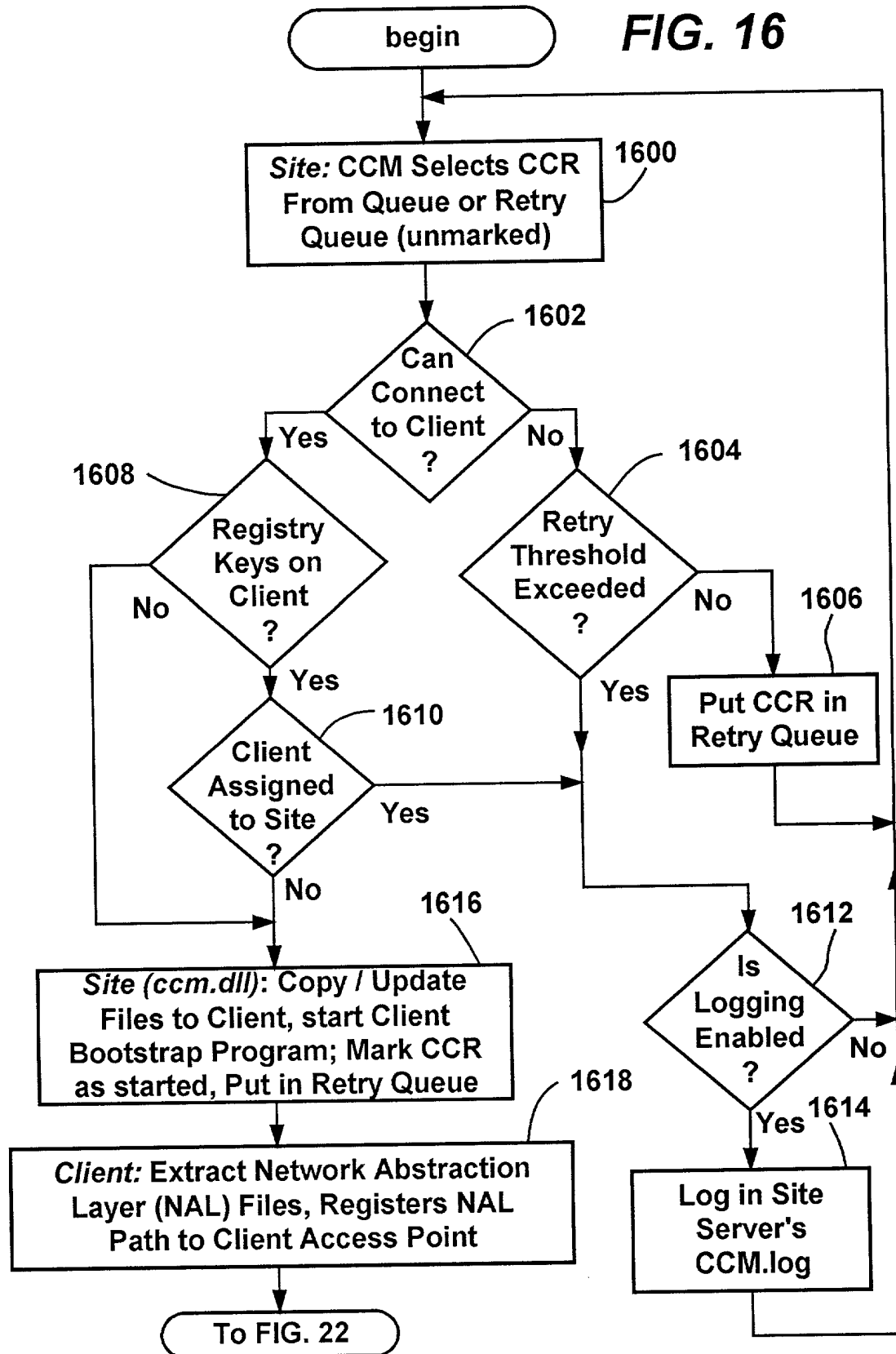
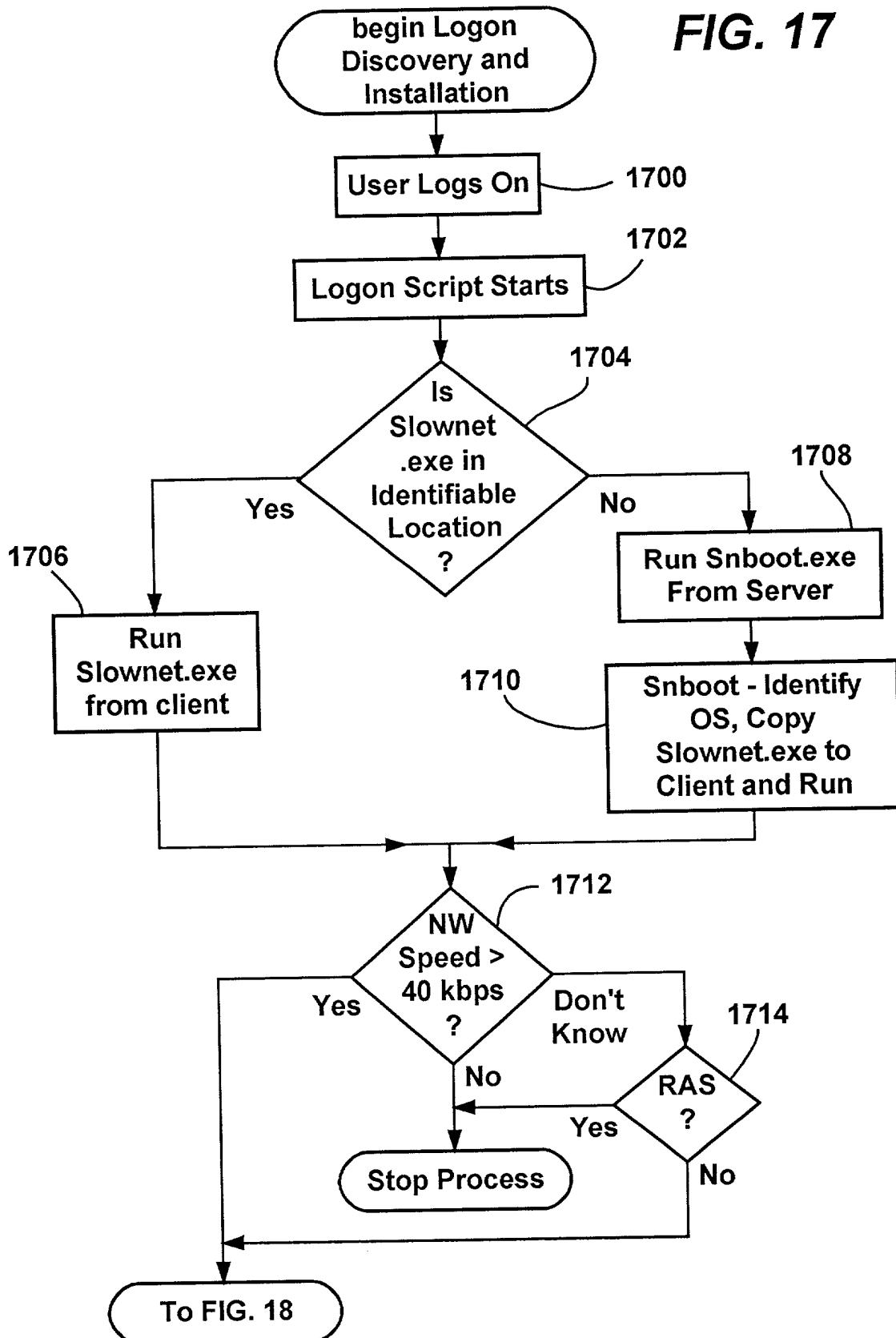
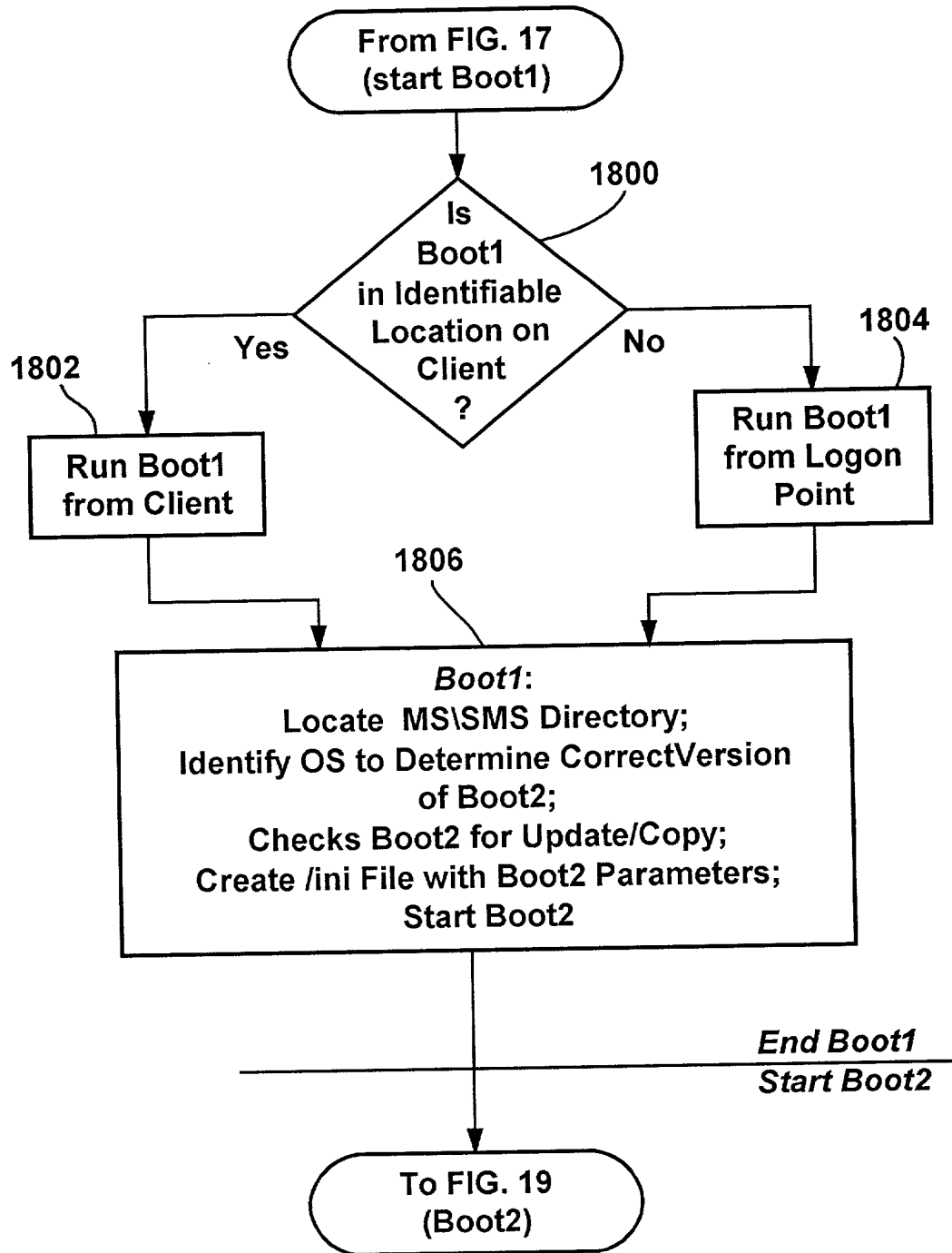


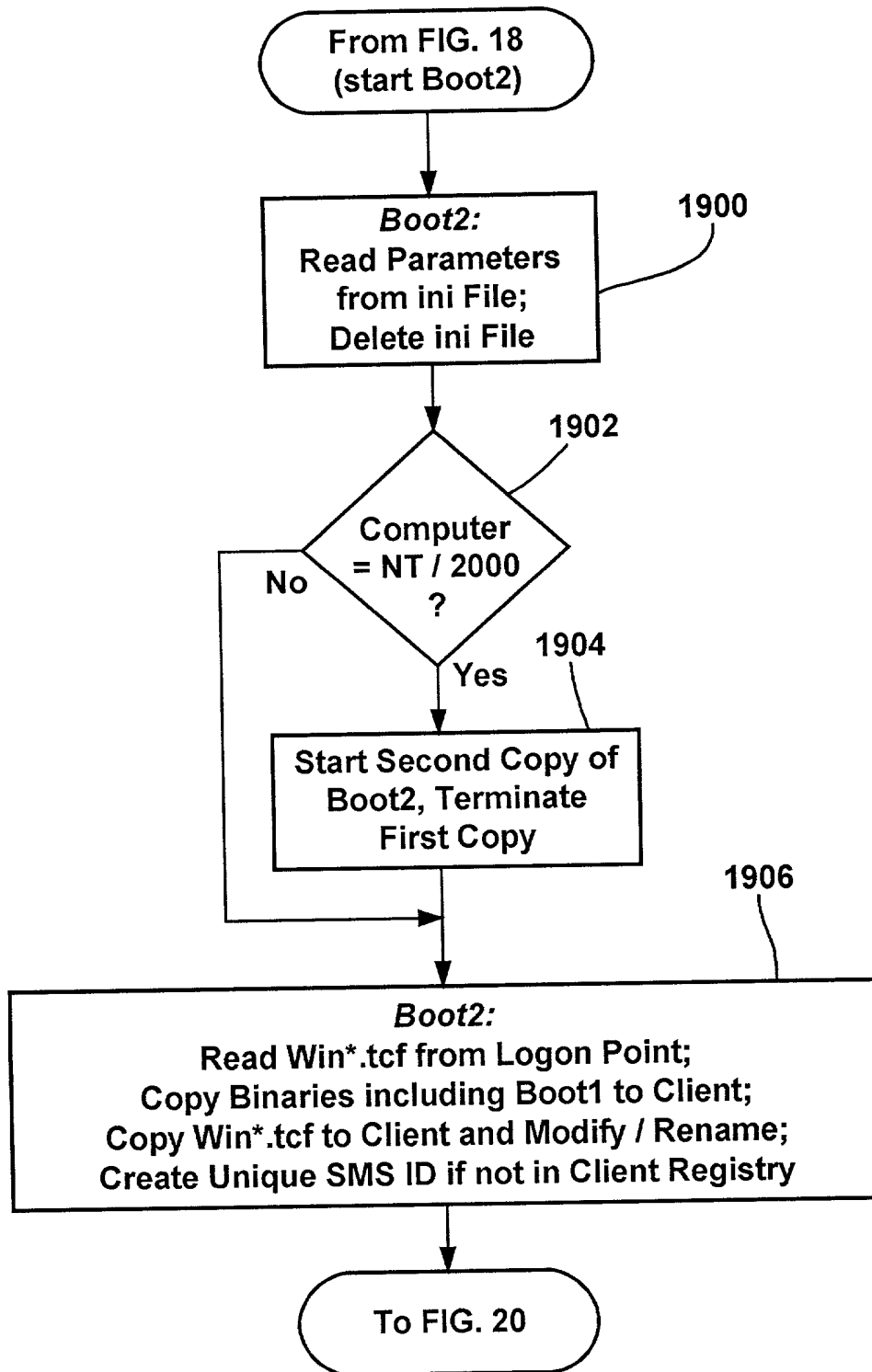
FIG. 17



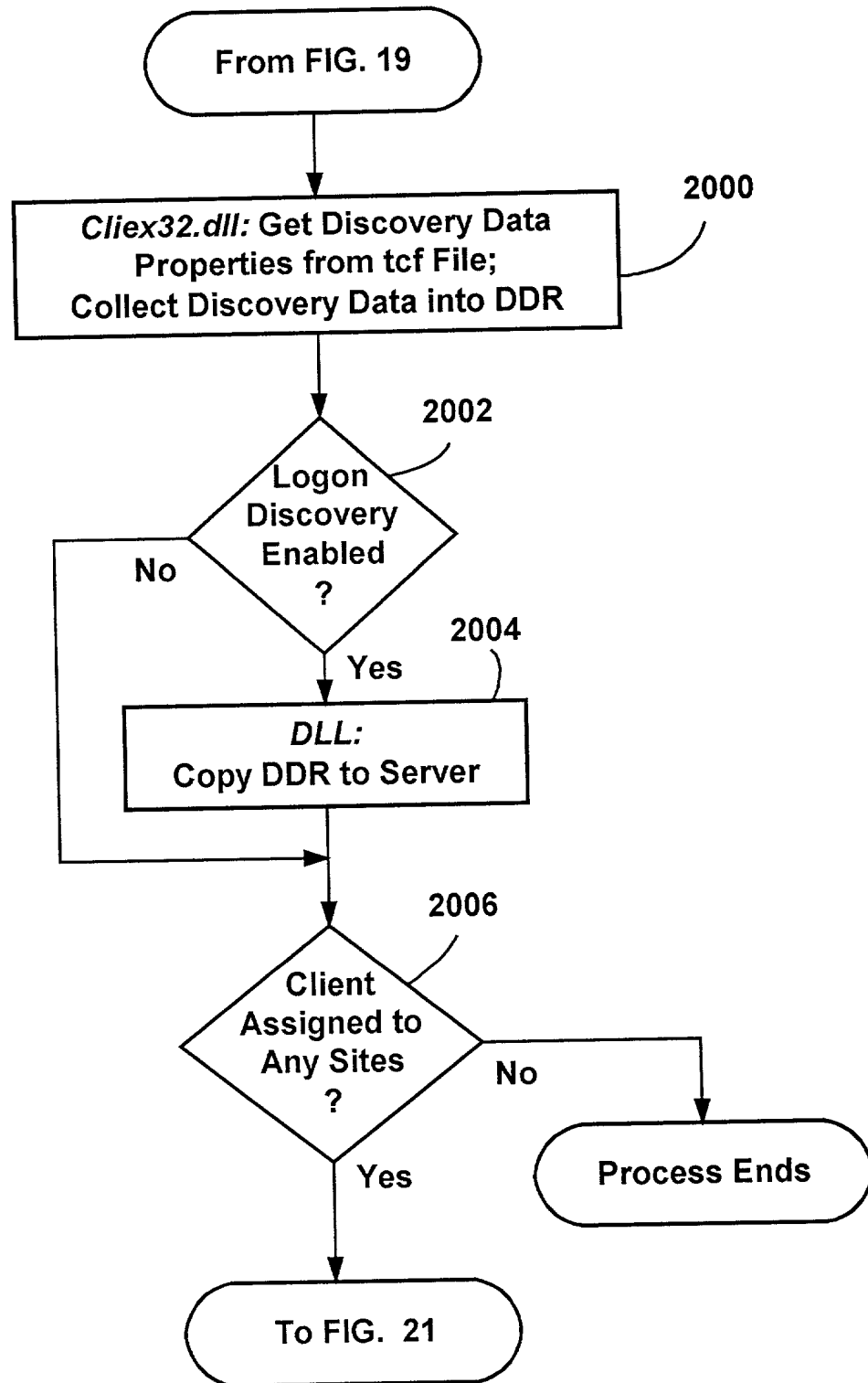
**FIG. 18**



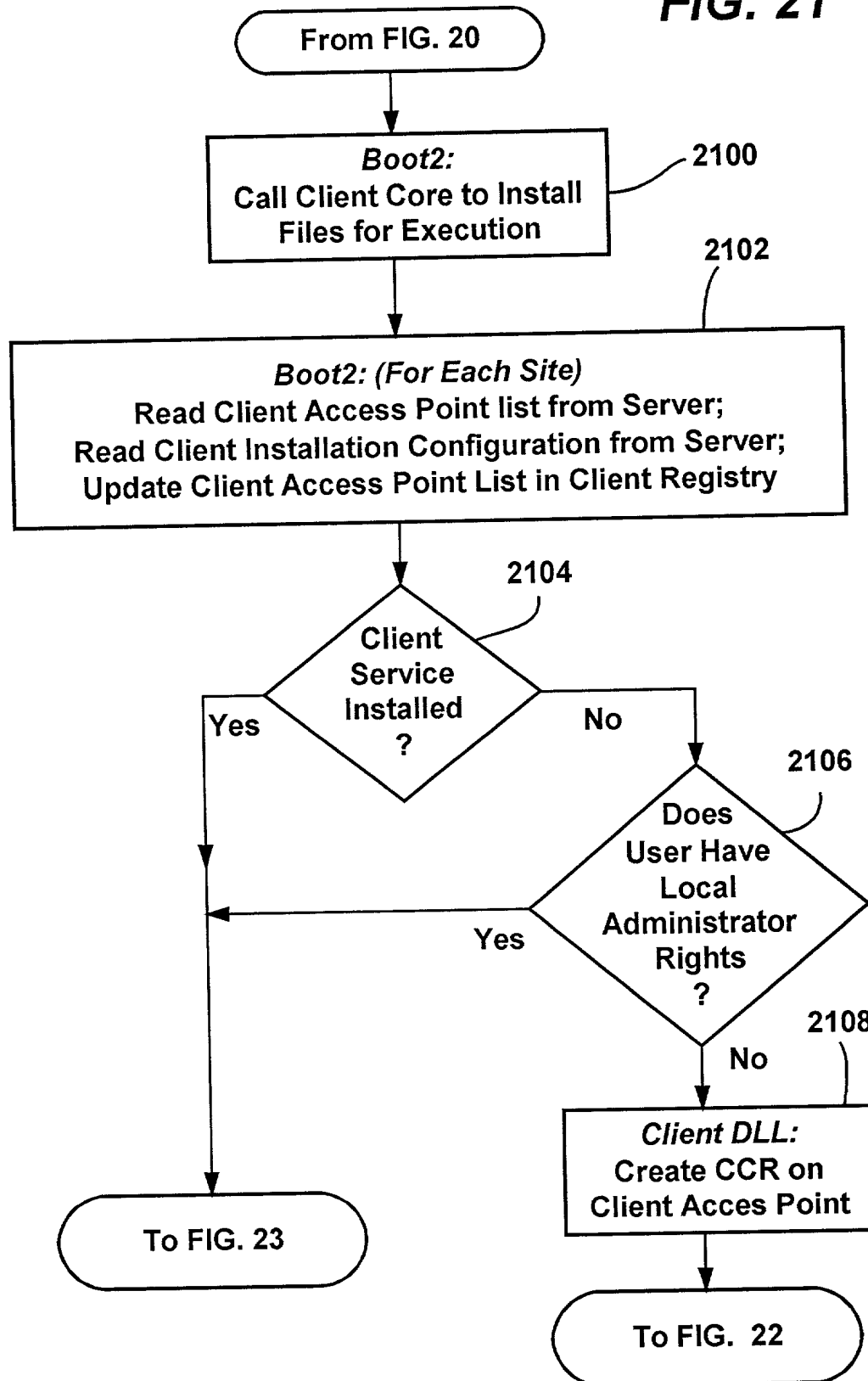
**FIG. 19**



**FIG. 20**

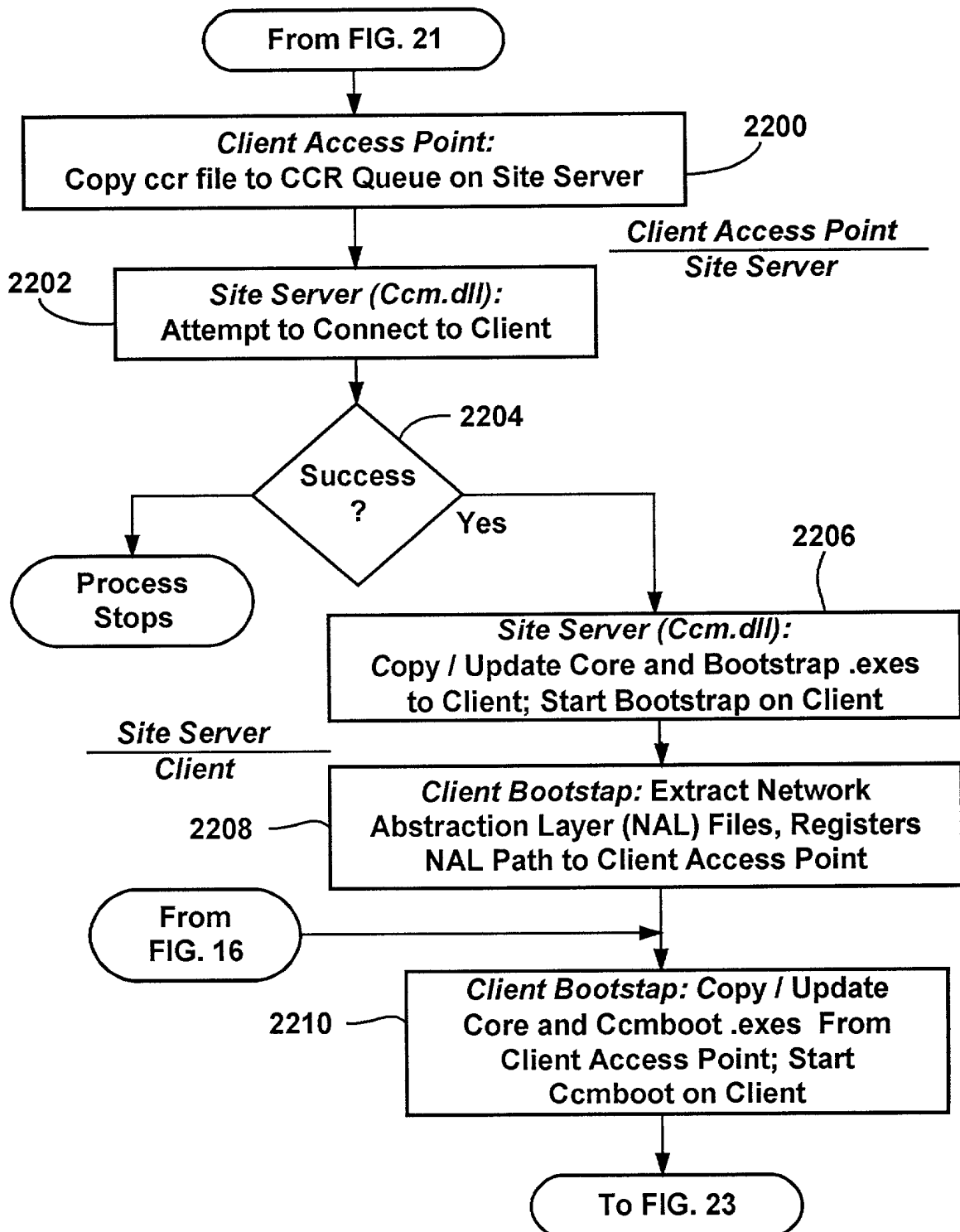


**FIG. 21**





**FIG. 22**



007230-9376550



FIG. 24

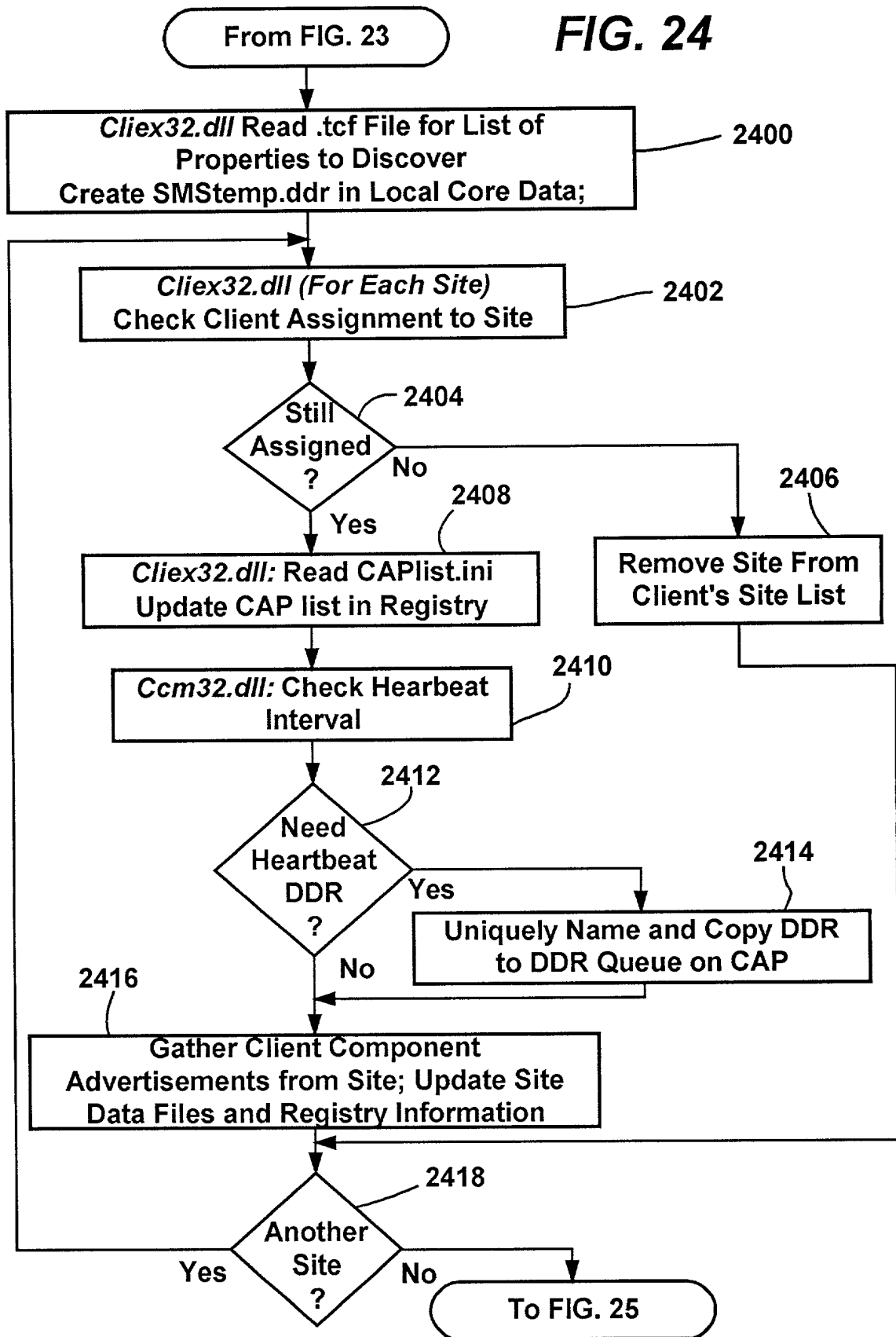
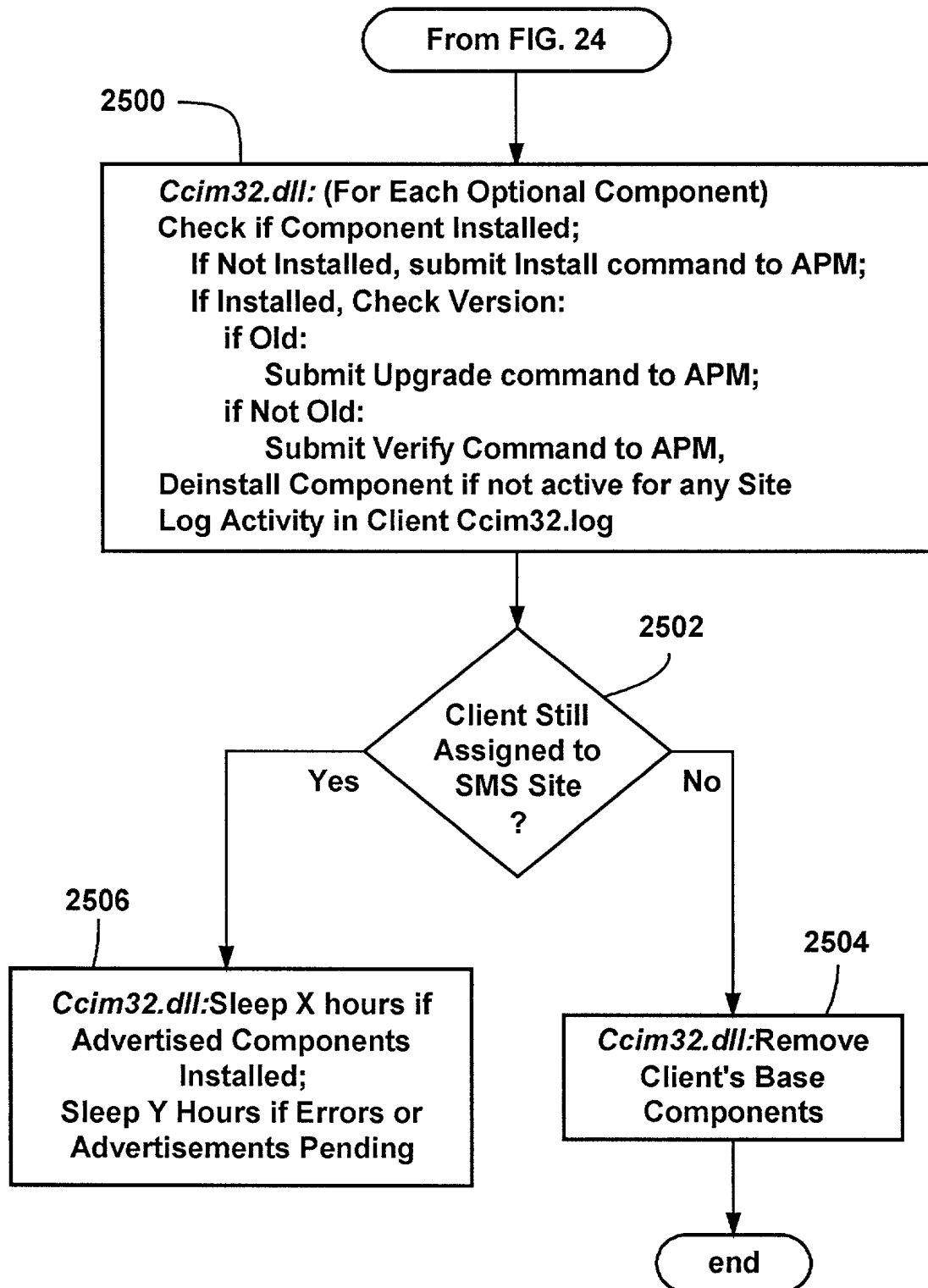


FIG. 25



COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: "**Method and System for Remote Client Installation**," the specification of which is attached hereto unless the following box is checked:

☐ was filed on \_\_\_\_\_, as United States Patent Application Number \_\_\_\_\_ or PCT International Application No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)

Priority Not Claimed

_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/>

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

60/142,099 _____ (Application Number)	July 2, 1999 _____ (Filing Date)
_____ (Application Number)	_____ (Filing Date)

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application(s) designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application.

_____ (Application Number)	_____ (Filing Date)	_____ (Status—patented, pending, abandoned)
-------------------------------	------------------------	--

As a named inventor, I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Albert S. Michalik, Reg. No. 37,395 Roger D. Wylie, Reg. No. 36,794  
John Whitaker, Reg. No. 42,222 Daniel D. Crouse, Reg. No. 32,022  
Katie E. Sako, Reg. No. 32,628.

Address all telephone calls to Albert S. Michalik at telephone number (425) 653-3520.

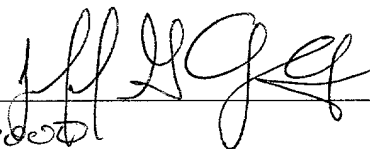
Address all correspondence to: Michalik & Wylie, PLLC  
14645 Bel-Red Road  
Suite 103  
Bellevue, WA 98007

I hereby declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of **sole or first inventor**: Jeff Young

Inventor's signature

Date

  
6/19/2000

Country of Citizenship: USA

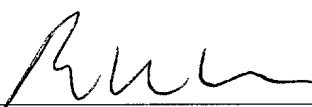
Residence: 2113 Bellevue Way SE, Bellevue, Washington 98004

Post Office Address: Same

Full name of **second inventor**: Bruce W. Copeland

Inventor's signature

Date

  
6/19/2000

Country of Citizenship: USA

Residence: 25618 NE 100th Street, Redmond, Washington 98053

Post Office Address: Same

☐ Additional inventors are being named on separately numbered sheets attached hereto.  
2230 declaration